Schwank
INNOVATIVE HEATING SOLUTIONS

infrasave
radiant heaters

Model SET - SETU & **Model** ITT - ITTU

TWO STAGE
LOW INTENSITY TUBE TYPE INFRARED HEATERS

INSTALLATION / OWNER'S MANUAL

WARNING Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death.

Read the installation and operating and maintenance instructions thoroughly before installing or servicing this equipment.

SAFETY ALERT:

This heater must be installed and serviced only by a trained gas service technician. Failure to comply could result in personal injury, death, fire and/or property damage.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

IF YOU SMELL GAS:

- Extinguish any open flame
- Do not attempt to light this or any other appliance
- Don't touch any electrical switch, or telephone
- Immediately call your gas supplier from a neighbor's phone
- Follow any and all instruction from your gas supplier
- If your gas supplier is not available, call the fire department

FIELD CONVERTIBILITY:
This appliance is field convertible to LP gas.

Keep this manual in a secure place .
Record for future reference:

Model #: _____

Serial #: _____
(located on heater rating label)

CSA CERTIFIED ®

DESIGN CSA CERTIFIED ®

SET(U)-F / ITT(U)-F Manual
IM091221
RD: FEB 2014
RL: 8B

NOTICE:

This manual is current for this product. Occasional revision of the product Certification Standard may require changes to the product and/or this manual.

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SET / SETU and ITT / ITTU SERIES
GAS FIRED INFRARED
LOW INTENSITY TUBE TYPE

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WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read and understand this installation and operation manual thoroughly prior to assembly, installation, operation or service to this appliance.

This heater must be installed and serviced only by a trained gas service technician.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

Failure to comply could result in personal injury, death, fire and/or property damage.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

This appliance may have sharp edges and corners. Wear protective clothing such as gloves and protective eye wear when servicing this or any other appliance.

APPLICATION

A gas-fired radiant tube heater may be installed for heating of commercial / industrial non-residential spaces. It is beyond the scope of these instructions to consider all conditions that may be encountered. Installation must conform with all local building codes or, in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 in the U.S.A. or the Natural Gas and Propane Installation Code, CSA B149.1 in Canada. The latest edition Electrical Code ANSI/NFPA N0 70 in the U.S.A. and PART 1 CSA C22.1 in Canada must also be observed.

Installation of a gas fired tube heater must conform to all heating installation design procedures including clearance to combustibles, connection to the gas and electrical supplies, and ventilation.

This heater is not for installation in a Class 1 or Class 2 explosive environment, nor a residence. If installation of this equipment is in question, consult with local authorities having jurisdiction (Fire Marshall, labor department, insurance underwriter, or others).

Revisions to codes and/or standards, may require revision to equipment and installation procedures. In case of discrepancy, the latest codes, standards, and installation manual will take priority over prior releases.

Models SET and **ITT** may be installed for two stage heating of commercial / industrial non-residential **indoor spaces.**

MODELS AVAILABLE FOR OTHER APPLICATIONS:

Models SPW-JZ *and* ***IWP*** *have a powder coated water resistant burner enclosure and may be installed for heating of commercial / industrial non-residential* ***outdoor spaces and wet indoor environments.***

Models STW-JZ *and* ***IW*** *have a stainless steel water resistant burner enclosure and may be installed for heating of commercial / industrial non-residential* ***outdoor spaces and harsh wet indoor environments.***

WARNING — Heater Expansion

It is a normal condition that during heat-up and cool-down a tube heater will expand and contract. Allowances for heater expansion must be made in the gas connection, venting and combustion air ducting. Improper installation, alteration, or adjustment can result in property damage, injury or death. **Refer to Section 13**

WARNING — Gas Connection

Improper installation, connection, or adjustment can result in property damage, toxic gases, asphyxiation, injury or death. Using an approved flexible gas connector in the USA or Type 1 hose connector in Canada, the gas supply to the heater must be connected and tested in accordance with all local, state, provincial, and national codes (ANSI Z223.1/NFPA 54 in USA; B149.1 in Canada) and as indicated in this manual. **Refer to Section 13**

WARNING — Venting

Inadequate venting of a heater may result in asphyxiation, carbon monoxide poisoning, injury or death. This heater may be directly or indirectly vented from the space. Venting must be in accordance with all local, state, provincial, and national codes (ANSI Z223.1/NFPA 54 in USA; B149.1 in Canada) and as indicated in this manual. **Refer to Sections 11 & 12**

WARNING — Start-Up 'SMOKE' Condition

During start up, the heating of material coatings used in the production process of tubes and reflectors will create smoke during the initial period of operation. This condition is normal and temporary .

Ensure that there is sufficient ventilation to adequately clear any smoke from the space.

Notify site and safety personnel to ensure that alarm systems are not unduly activated.

IMPORTANT — THERMOSTAT SETTING FOR COMFORT

Infrared radiant (IR) heating system provide comfort with the effect of radiant heat and ambient air heat.

If your IR system is controlled with a ThermoControl Plus controller that senses radiant heat, then set the thermostat to the desired comfort temperature (ie: 65°; 68°; 20°C).

If your IR system is controlled with a standard 24V or 120V thermostat that senses only air temperature, then start with a thermostat setting that is 5° to 7°F (3° to 5°C) lower than the desired comfort temperature. Some trial and error setting may be required to 'fine tune' the comfort temperature that best suits your site and provides most economical operation.

Unoccupied (night) set-back of 9°F (5°C) is recommended. Do not turn system 'Off'.

WARNING Tube “GLOW”

It is a normal condition that the combustion tube (1st tube) can appear to “glow red”. For inputs up to 150,000 Btuh, the top surface of the tube can appear red where heat is trapped between the reflector and the tube. The stainless steel tube used for inputs 175,000 and greater can appear to entirely glow red. The tube material is designed into the heater because it can withstand the high temperature of combustion, and the “red glow” is a normal occurrence.

WARNING Clearance to combustibles

Location of flammable or explosive objects, liquids or vapors close to the heater may cause fire or explosion and result in property damage, injury or death. Do not use, store or locate flammable or explosive objects, liquids or vapors in proximity of the heater.

The clearance to combustible material represents the minimum distance that must be maintained between the outer heater surface and a nearby surface. The stated clearance to combustibles represents a surface temperature of 90F° (50C°) above room temperature. It is the installer’s responsibility to ensure that building materials with a low heat tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain the required clearances from the heater to the combustibles. Such signs must either be posted adjacent to the heater thermostats or in the absence of such thermostats in a conspicuous location. In addition to stored or stationary material, consideration must also be given to moveable objects such as cranes, vehicles, and overhead doors, and structural objects such as sprinkler heads, electrical and gas lines, and electrical fixtures.

It is beyond the scope of these instructions to consider all conditions that may be encountered. Consult local authorities such as the Fire Marshall, insurance carrier, or safety authorities if you are uncertain as to the safety or applicability of the proposed installation.

Refer to Figure 1 and Table 1 for the certified clearances to combustibles for the appropriate model input/size.

FIGURE 1 MINIMUM CLEARANCES TO COMBUSTIBLES* - *refer to* Table 1 *for values*

NOTE: **A 'PEEL & STICK' SIGN IS SUPPLIED:** USE AN INDELIBLE MARKER TO ENTER VALUES 'H', 'S', 'F', & 'B' ON .

POST THE SIGN ADJACENT TO THE HEATER THERMOSTAT OR IN A PROMINENT LOCATION. *See next page for details.*

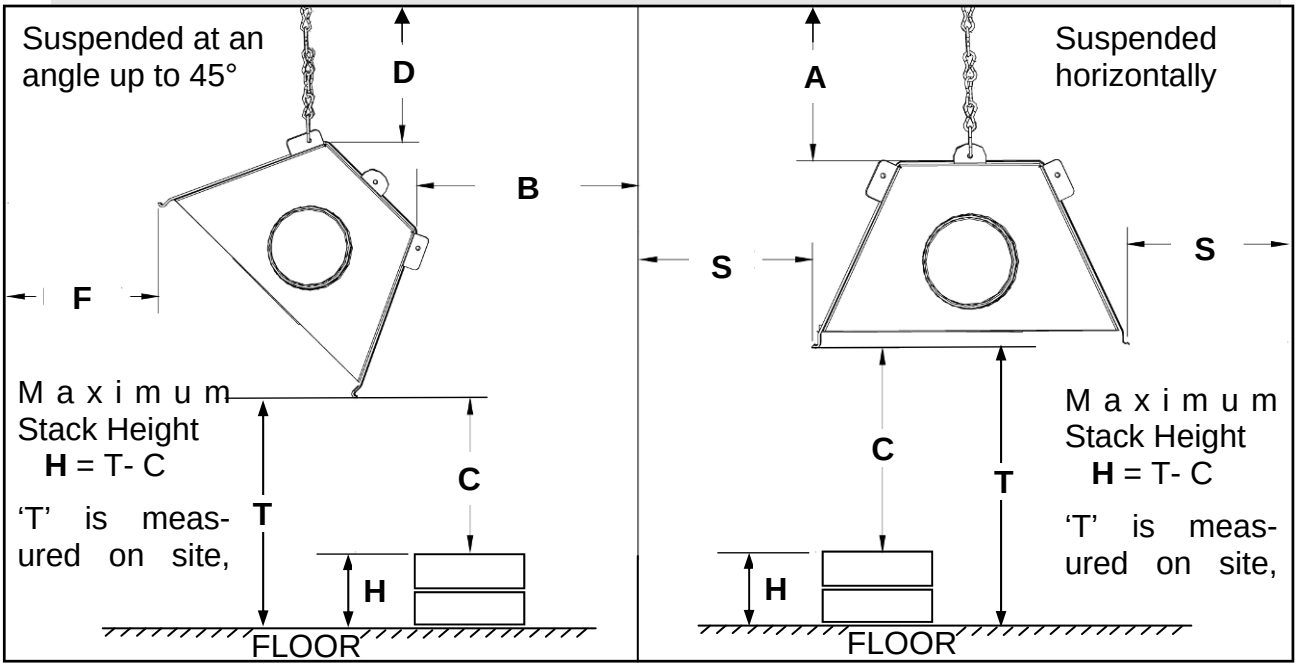


TABLE 1 MINIMUM CLEARANCES TO COMBUSTIBLES*

MODEL SET(U) / ITT(U) Both "Straight" & "U-Tube"	HORIZONTAL			ANGLE UP TO 45 DEGREES			
	TOP	SIDE	BELOW	TOP	REAR	FRONT	BELOW
	A inches (cm)	S inches (cm)	C inches (cm)	D inches (cm)	B inches (cm)	F inches (cm)	C inches (cm)
200,000/140,000	7" (18)	22" (56)	68" (172)	7" (18)	1" (2.5)	57" (145)	68" (172)
175,000/125,000	6.5" (16.5)	20" (51)	68" (172)	6.5" (16.5)	1" (2.5)	47" (119)	68" (172)
155,000/110,000	6" (15)	19" (48)	64" (163)	6" (15)	1" (2.5)	44" (112)	64" (163)
130,000/90,000	4" (10)	11" (28)	60" (152)	5" (13)	1" (2.5)	35" (89)	56" (142)
110,000/75,000	3" (8)	10" (25)	60" (152)	4.5" (11)	1" (2.5)	26" (66)	54" (137)
100,000/70,000	7" (18)	22" (56)	68" (172)	7" (18)	1" (2.5)	57" (145)	68" (172)
80,000/60,000	2.5" (6)	6" (15)	42" (107)	3.5" (9)	1" (2.5)	23" (59)	38" (97)

***NOTE:** **Clearances are measured from the reflector**.

The clearance to combustible materials represents the minimum distance that must be maintained between the heater and a nearby surface. **The stated clearance to combustibles represents a surface temperature of 90F° (50C°) above room temperature.**

It is the installer's responsibility to ensure that building materials with a low heat

tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

VENT END CLEARANCE: Clearances from the vent pipe are determined by local or national installation codes, but must not be less than 6 inches (15 cm). For 'unvented' installation, a minimum distance of 24 inches (61 cm) is required from the end of heater to a combustible surface.

WARNING **In locations used for the storage of combustible materials: Signs must be posted** specifying the *maximum permissible stacking height* to maintain the required clearances from the heater to the combustibles.

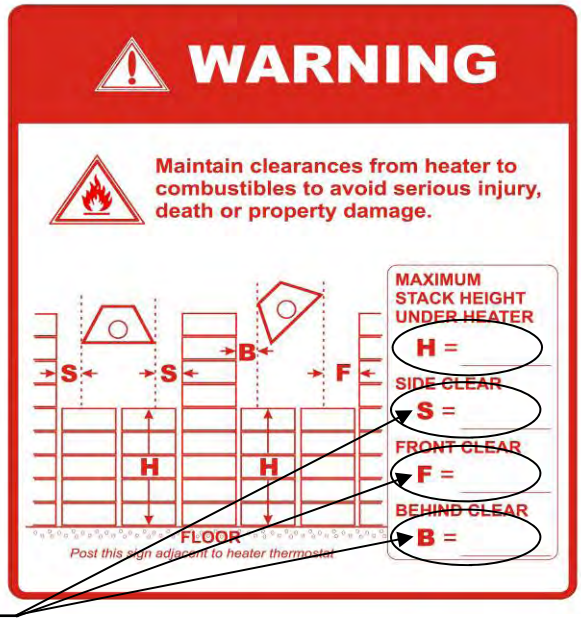
The signs must be posted either adjacent to the IR heating system thermostats or in the absence of such thermostats, in a conspicuous place.

For your convenience a "peel and stick" sign is provided with this heater. Use a permanent marker to record the required dimensions on the sign.

To calculate the value '**H**': (**H** = **T** - **C**)

- Measure the on site distance between bottom of the heater and the floor = '**T**' inches (cm).
- Refer to Table 1 to get the value '**C**' that corresponds to the model you are installing
- Subtract the clearance below the heater '**C**' from '**T**' to get value '**H**'.
- Enter this value '**H'** on the sign.

Refer to the information for the heater model being installed in Figure 1 and Table 1 to get the values for dimensions '**S**', '**F**' and '**B**'.



Post this sign as instructed above.

1. LABOR REQUIRMENTS

Two persons are required to safely install this equipment. Wear gloves and other required safety protection.

2. INSTALLATION IN COMMERCIAL AIRCRAFT HANGARS

Low intensity radiant tube heaters are suitable for use in aircraft hangars when installed in accordance with the latest edition of the Standard for *Aircraft Hangars*, ANSI/NFPA No 409 in the USA, or the Canadian *Natural Gas and Propane Installation Code*, B149.1.

A. A minimum clearance of 10 ft (3 m) above either the highest fuel storage compartment or the highest engine enclosure of the highest aircraft which may occupy the hangar. The clearance to the bottom of the heater shall be measured from the upper surface of either the fuel storage compartment or the engine enclosure, whichever is higher from the floor.

B. A minimum clearance of 8 ft (2.4 m) must be maintained from the bottom of the heater to the floor in other sections of the aircraft hangar, such as offices and shops, which communicate with areas for servicing or storage. Refer to Section 1 for proper mounting clearances to combustibles.

C. Heaters must be located so as to be protected from damage by aircraft and other objects, such as cranes and movable scaffolding.

D. Heaters must be located so as to be accessible for servicing and adjustment.

3. INSTALLATION IN COMMERCIAL GARAGES AND PARKING STRUCTURES

Low Intensity Heaters are suitable for use in commercial garages when installed in accordance with the latest edition of the Standard for *Parking Structures*, ANSI/NFPA 88A, or the Standard for *Repair Garages*, ANSI/NFPA No. 88B, or the Canadian *Natural Gas and Propane Installation Code*, B149.1.

WARNING

An overhead heater shall be located high enough to maintain the minimum distance to combustibles, as shown on the heater rating plate, from the heater to any vehicles parked below the heater.

Overhead heaters shall be installed at least 8 ft (2.4 m) above the floor.

4. INSTALLATIONS OTHER THAN SPACE HEATING

Use for process or other applications that are not space heating will void the C.S.A. certification and product warranty. Process application requires field inspection and/or certification by local authorities having jurisdiction.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read and understand this installation and operation manual thoroughly prior to assembly, installation, operation or service to this appliance.

This heater must be installed and serviced only by a trained gas service technician.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

Failure to comply could result in personal injury, death, fire and/or property damage.

Do not store or use gasoline or other flammable vapours and liquids in the vicinity of this or any other gas fired appliance.

5. PRE INSTALLATION SURVEY

It is recommended that a full heating design including heat loss calculation be conducted on the structure or area to be heated. Heater sizing and placement must consider available mounting height, sources of greatest heat loss, and the certified clearances to combustibles with respect to stored material, moveable objects (cranes, vehicles, lifts, overhead doors, etc), sprinkler system heads, and other obstructions on the site. Consideration must also be given to vent / duct placement and the allowable combined lengths of vent and duct. Carefully survey the area to be heated, and for best results place burner and combustion chamber in the coldest area(s) .

Installation must conform with all local, state, provincial and national code requirements including the current latest edition ANSI Z223.1 (NFPA 54) in the U.S.A. and B149.1 installation code in Canada, for gas burning appliances and equipment. The latest edition Electrical Code ANSI/NFPA N0 70 in the U.S.A. and PART 1 CSA C22.1 in Canada must also be observed.

The heating system must have gas piping of the correct diameter, length, and arrangement to function properly. For this reason, a layout drawing is necessary.

6. MOUNTING CLEARANCES

This heater must be mounted with at least the minimum clearances between the heater and combustibles as shown in FIG-1, TABLE 1, Page 7. It is the installer's responsibility to ensure that building materials with a low heat tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

Positioning of lights, sprinkler heads, overhead doors, storage areas, gas and electrical lines, parked vehicles, cranes and any other possible obstruction or hazard must be evaluated prior to installation.

Ensure adequate clearance around the air intake at the burner to allow sufficient combustion air supply to the heater.

6A. SERVICE CLEARANCE: The lower 'jaw' of the burner cabinet swings down to provide convenient service access to burner components. Provide a minimum clearance from any wall or obstruction of 6 inches (15 cm) to the access end of the burner housing, and a minimum of 24 inches (61 cm) to any ONE side to allow servicing of burner, blower and controls. (see Figure 2) - the minimum clearances to combustibles must always be maintained.

For guidelines to heater placement refer to TABLE 2 (below).

FIGURE 2

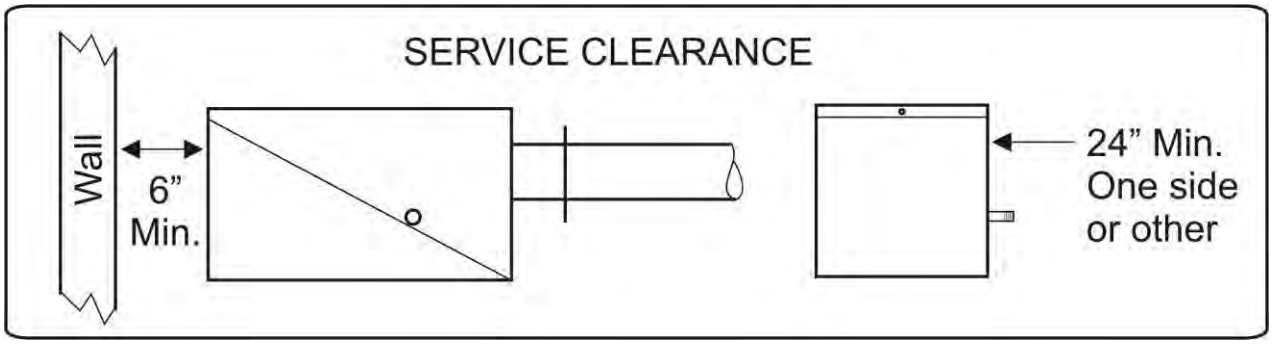


TABLE 2: GUIDELINES FOR HEATER PLACEMENT

MODEL "Straight" or "U-Tube"	MOUNTING HEIGHT **ft** (m)	MAXIMUM DISTANCE BETWEEN HEATERS **ft** (m)	DISTANCE – OUTSIDE WALL TO HEATER LONG AXIS (PARALLEL TO WALL) IN "FEET"	
			HORIZONTAL **ft** (m)	ANGLE
SET / ITT 200/140	**18 – 25** (6 - 8)	**50** (15)	**17 – 25** (5 - 8)	MINIMUM = COMBUSTIBLE CLEARANCE BEHIND (refer to Table 1)
SET / ITT 175/125	**18 – 25** (6 - 8)	**50** (15)	**17 – 25** (5 - 8)	
SET / ITT 155/110	**16 – 21** (5 - 7)	**45** (14)	**15 – 20** (5 - 7)	
SET / ITT 130/90	**15 – 21** (5 - 7)	**40** (12)	**15 – 20** (5 - 7)	
SET / ITT 110/75	**13 – 19** (4 - 6)	**35** (11)	**13 – 18** (4 - 6)	
SET / ITT 100/70	**13 – 19** (4 - 6)	**35** (11)	**13 – 18** (4 - 6)	
SET / ITT 80/60	**10 – 16** (3 - 5)	**30** (9)	**12 – 16** (4 - 5)	

* RECOMMENDED MOUNTING HEIGHTS are typical to provide optimum comfort in general space heating applications. Variance to these typical heights can occur in some applications:

- Higher mounting heights due to structure or application requirements
- Lower mounting heights for area or 'spot' heat, or in areas with greater infiltration losses (near overhead doors, etc)

IMPORTANT: Single or multiple heater placement must be such that continuous operation of heater(s) will not cause combustible material or materials in storage to reach a temperature in excess of ambient temperature plus 90F° (50C°).

It is the installer's responsibility to ensure that building materials with a low heat tolerance which may degrade at lower temperatures are protected to prevent degradation. Examples of low heat tolerance materials include vinyl siding, fabrics, some plastics, filmy materials, etc.

Refer to "Clearance to Combustibles" information on pages 6 to 8, and Figure 1 and Table 1.

7. SYSTEMS INCORPORATING 90° ELBOWS AND 180° ELBOWS

The radiant tube heater can be installed in configurations as illustrated in FIGURE 4. (below) with a maximum of two 90° elbows per heater. The use of elbows reduces the total maximum vent allowable. (See Section 11 : Flue venting)

90° elbows (JS-0528-SM) are shipped as a kit with one coupler, and two reflector end caps.

The SET / ITT is available in a “U-Tube” model - SETU / ITTU - using a 180° turn box. A double wide reflector covers the double tube run. Alternately, for a 180° elbow, order 2 x 90° kits that connect to create a 180°.

IMPORTANT: Models with input 100/70 Mbh x 20 ft (30 kW x 6 m) must only be installed as a straight system with no elbows allowed at the 10 ft (3 m) location.

Elbow Location / Input: A minimum run of straight radiant tube must be connected to the burner before any elbow as follows: Inputs 200 (60 kW) and 175 Mbh (50 kW) = 25 ft (7.6 m); Input 155 Mbh (45 kW) = 20 ft (6 m); Inputs 130 Mbh (38 kW) and 110 Mbh (32 Kw) = 15 ft (4.6 m); and Input 80 Mbh (23 kW) a minimum of 10 ft (3 m) straight tube before elbow.

FIGURE 3 SYSTEM ELBOW KIT - *see page 50 for 180° elbow dimensions*

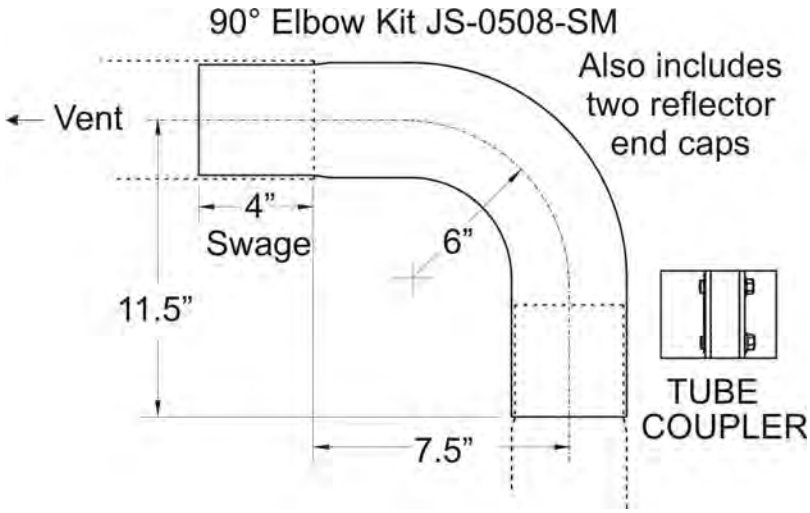
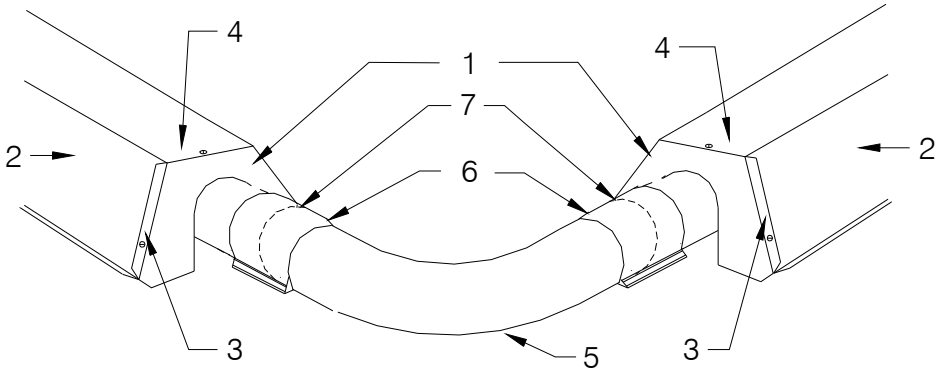


FIGURE 4 90° ELBOW INSTALLATION



1 End-Cap
2 Reflector
3 End Cap Flange OVER Reflector
4 End Cap Flange UNDER Reflector
5 90^0 Elbow
6 Tube Coupler
7 Unswaged end of elbow and tube (swage of previous tube or elbow inserted).

8. SUSPENDING THE SYSTEM - GENERAL

Inadequate or improper suspension of the tube heater can result in collapse of the system, property damage, and personal injury or death.

It is the installer's responsibility to ensure that the hardware and structural supports from which the heater is suspended are sound and of adequate strength to support the weight and expansion forces of the heater.

Consider that the heater will expand in length as much as 1/2 inch (12.5 mm) or more for every 10 ft (3 m) of system length – typically the greater the firing rate, the greater the expansion.

Refer to Sections 13 & 14

1) Survey the available structural supports, considering the system configuration and heat requirements of the area to establish the optimum heater location.
   a) Locating a heater directly under joists or beams, or installing supplemental steel support rail or angle iron can substantially reduce labor and materials
2) Hardware with a minimum 60 lb. (30 kg) work load must be used at each heater suspension point. A #8 Jack Chain or equivalent is typically used for suspending the heater.
   a) Connect to the structure using typical hardware as illustrated in FIGURE 6 (below) or by other mechanically sound means
   b) If rigid devices such as 3/8" threaded rods are used for suspension, swing joints or other means must be provided to allow for system expansion - approximately ½ inch to 1 inch for every 10 ft (1 cm to 2.5 cm for every 3 m) of system length.
3) Tube system hangers must be located:
   i: Straight in line
   ii: At a common height (level)

   NOTE: It is important that the tubes in the system are installed in alignment horizontally (level) and vertically (in line) – this will ensure system integrity

FIGURE 5 SYSTEM CONFIGURATIONS

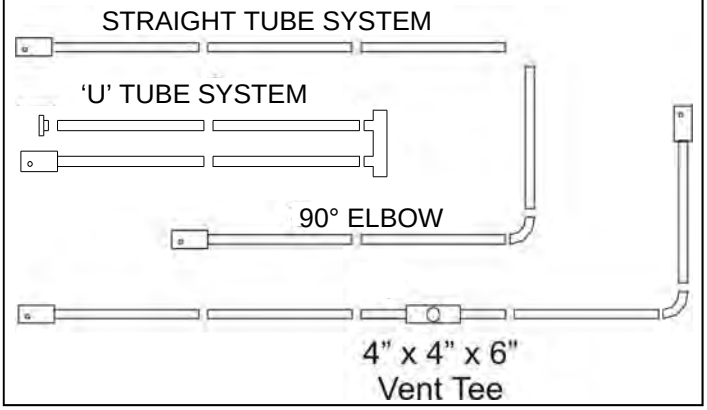


FIGURE 6 TYPICAL MOUNTING HARDWARE

HOOK OR EYE BOLT THROUGH

BEAM CLAMP WITH HOOK OR EYE

HOOK OR EYE

PIPE RING OR CLEVIS

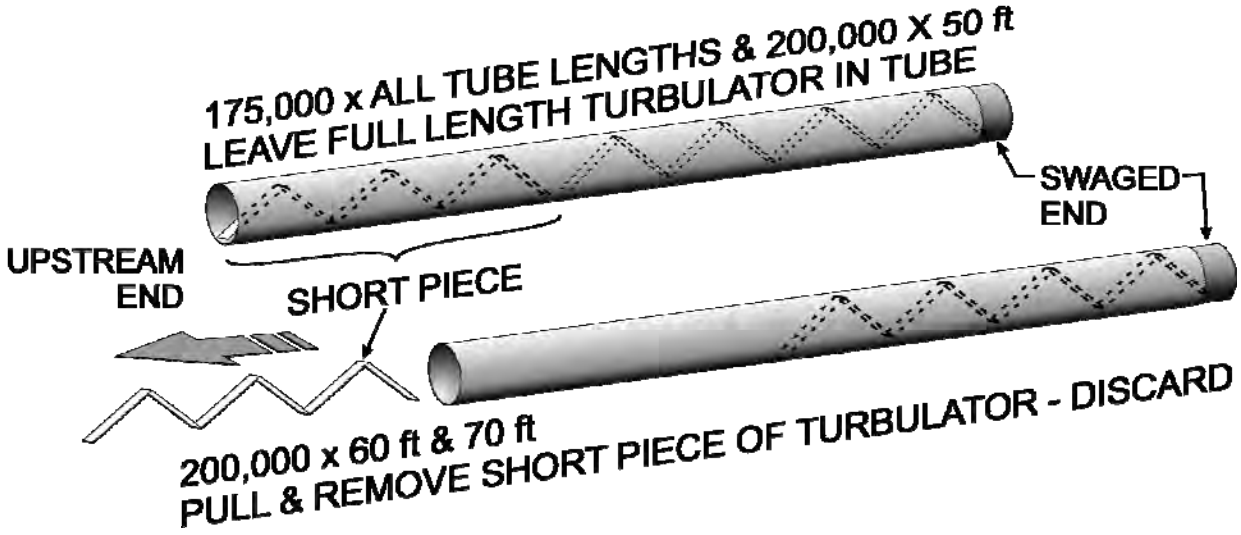
BAR-JOIST CLAMP

NOTE: It is the installer's responsibility to ensure that mounting hardware and fastening to structure are of sufficient strength to support the system.

9 INSTALLATION OF HANGERS, TUBES AND BURNER

TURBULATOR NOTES:

1. **200,000 x 60 ft & 70 ft: REMOVE SHORT PIECE OF TURBULATOR FROM UP-STREAM END OF LAST TUBE PRIOR TO INSTALLATION OF TUBE**
2. **Turbulators are ALWAYS installed at the vent end of the heater.**


175,000 x ALL TUBE LENGTHS & 200,000 X 50 ft
LEAVE FULL LENGTH TURBULATOR IN TUBE
SWAGED END
UPSTREAM END
SHORT PIECE
200,000 x 60 ft & 70 ft
PULL & REMOVE SHORT PIECE OF TURBULATOR - DISCARD

9.1 SET / ITT STRAIGHT TUBE SYSTEM ~ BURNER AND TUBE INSTALLATION

1) Install Hangers:
   - i: No closer than 3” (5 CM) and no further than 5” (10 cm) from the burner/tube flange
   - ii: No closer than 6” (15 cm) either side of a tube connection in the system
   - iii: No further than 24” (61 cm) either side of a tube connection in the system

2) With all hangers in alignment and suspended at the same height, insert first aluminized tube section, through 4" hole into first two wire hangers.

   NOTE: INSTALL THE FIRST AND SECOND TUBES (FROM BURNER END) WITH THE WELDED SEAM ALONG THE TUBE LENGTH FACING DOWNWARD

3) Bolt burner to flange on first tube section, SEE FIGURE 8.

IMPORTANT NOTE: Models with inputs 100,000, 175,000 & 200,000 refer to section 9.3

4) Slide a Torctite tube coupler over the swaged end of the first tube, then join the second tube over the swage in the first tube

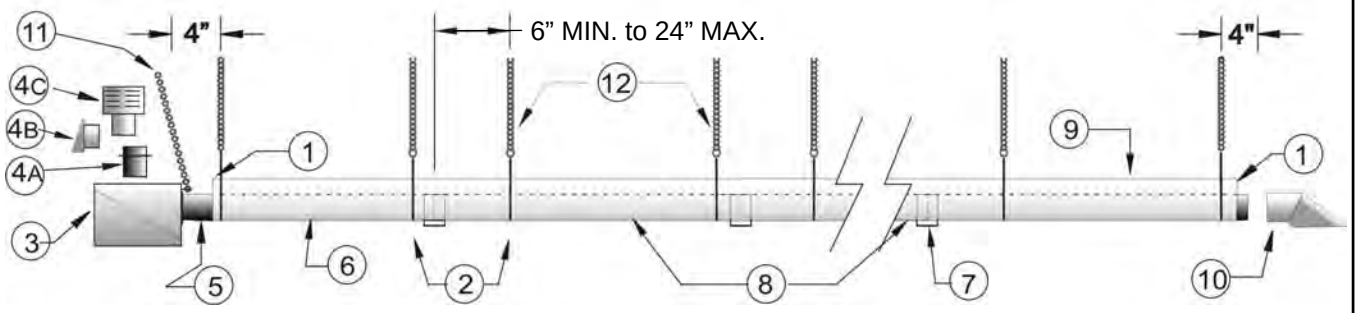
5) Slide the Torctite coupler into position across the center of the joint - SEE FIGURE 9

6) IMPORTANT: TOURQUE THE COUPLER BOLTS TO 40 ft-lbs

7) Subsequent lengths of tube can then be installed, by joining them together swaged portion inside the next tube and locking the joints using the Torctite coupler. SEE FIGURE 9.

8) If there is a 90° elbow in the system refer to Section 7 and Figures 3 & 4

FIGURE 7: STRAIGHT TUBE TYPICAL HANGER & SUPPORT SPACINGS

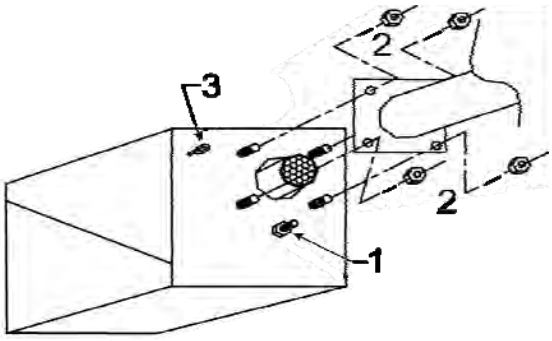


SUSPEND ALL TUBES BY TWO (2) HANGERS PER 10' LENGTH, LOCATE HANGERS BETWEEN 6" to 24" FROM EACH TUBE CONNECTION.

1ST & 2ND TUBES FROM BURNER END: INSTALL WELDED SEAM FACING DOWNWARD.

1 - END CAP
2 - WIRE HANGER
3 - BURNER ASSEMBLY
4 - COMBUSTION AIR OPTIONS:
4A - JS-0532-SE 4" INTAKE ADAPTER
4B - JS-0532-VC 4" WALL CAP
4C - JA-0528-XX 4" ROOF CAP
5 - SIGHT GLASS
6 - ALUMINIZED TUBE WITH FLANGE
7 - TORCTITE TUBE COUPLER
8 - STEEL TUBE(S)
9 - REFLECTOR
10 - FLUE VENT TERMINAL
11 - BURNER SUPPORT CHAIN
12 - HANGER SUPPORT CHAINS

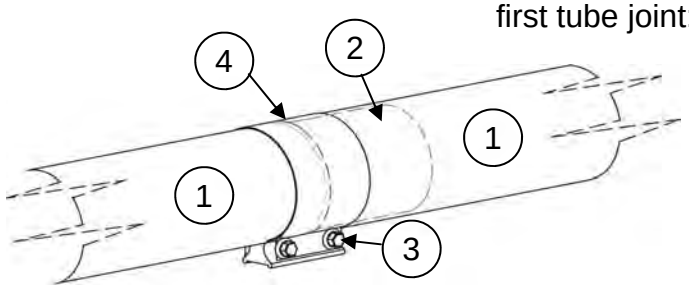
FIGURE 8: BOLT BURNER TO TUBE FLANGE



Note: Flange Gasket not required between burner and tube flange

1. Fifth Nut (Holds Inner Burner to Housing - Do Not Loosen or Remove)
2. Insert four burner bolts through the tube flange, secure tightly with lock nuts.
3. Secure suspension chain to eye bolt to stabilize burner

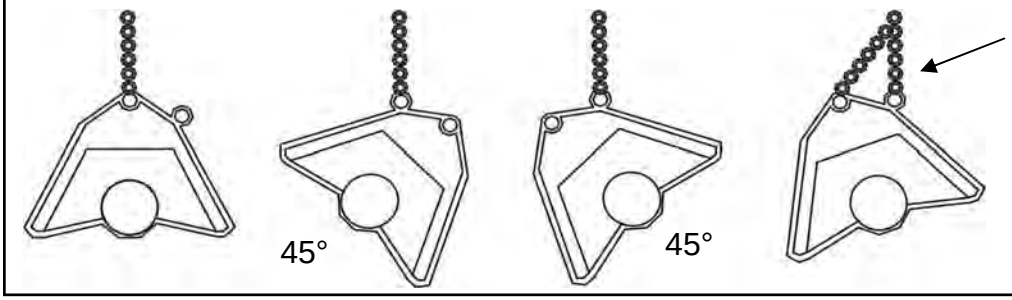
FIGURE 9: COUPLER INSTALLATION (**NOTE**: See Section 9.3 for 'Special Couplers' at first tube joint: 100,000 x 20 ft & 175 / 200,000 models)



1. Tube
2. Swaged end of upstream tube
3. Tube Coupler
4. Centre coupler over tube joint

Tighten coupler bolts to 40 ft-lbs.

FIGURE 10: HANGER / REFLECTOR ORIENTATION HORIZONTAL TO 45^0



9.2 SETU / ITTU 'U'-TUBE SYSTEM ~ BURNER AND TUBE INSTALLATION

TURBULATOR NOTES: Turbulators are ALWAYS installed at the vent end of the heater.
200,000 x 60 FT & 70 FT: REMOVE 4 ft TURBULATOR PIECE FROM UPSTREAM END OF LAST TUBE PRIOR TO INSTALLATION OF TUBE

1) Install Hangers using chain or other suitable suspension hardware at each side of the hanger: See Figure 11 next page

   i: Two hangers for first section (from burner), and one hanger for each additional section

   ii: No closer than 12" (30 cm) and no further than 14" (35 cm) from the burner/tube flange

   iii: No closer than 6" (15 cm) from a tube connection in the system

   iv: No further than 18" (61 cm) from a tube connection in the system

   v: If angle mounting a 'U' Tube model, the vent side must be in the upper position

2) With all hangers in alignment and suspended at the same height (and angle), insert first aluminized tube section on to the first two hangers: See Figure 12A next page

   - Also lay the vent end tube on to the first two hangers - check tubes for turbulator label to ensure the correct tube is located at the vent end

   NOTE: INSTALL THE FIRST AND SECOND TUBES (FROM BURNER) WITH THE WELDED SEAM ALONG THE TUBE LENGTH FACING DOWNWARD

3) Fasten flanged tube to hangers with 'U' bolts:

   - All tubes on the burner-side of the heater are bolted to the hangers with 'U' bolts
   - Tubes on vent-side simply rest in the hanger notch and do not fasten to the hanger.

4) Bolt burner to flange on first tube section - SEE FIGURE 8 previous page.

IMPORTANT NOTE: Models with inputs 175,000 & 200,000 refer to section 9.3

5) Slide a Torctite tube coupler over the swaged end of the first tube, then join the second tube over the swage in the first tube -

6) Slide the Torctite coupler into position across the center of the tube joint - SEE FIGURE 9

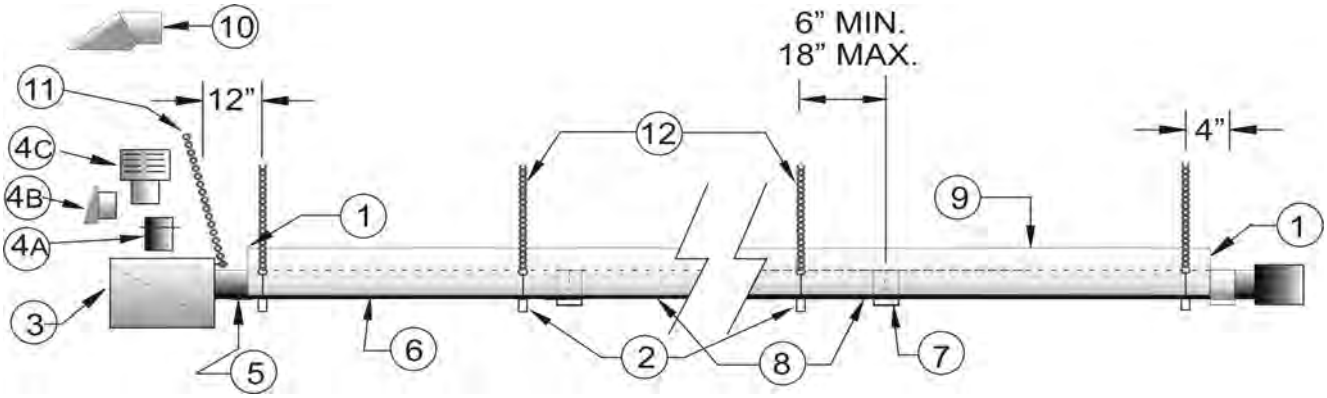
7) IMPORTANT: TOURQUE THE COUPLER BOLTS TO 40 ft-lbs

8) Subsequent lengths of tube can then be installed on both sides of the hangers by joining them together swaged portion inside the next tube and locking the joints using the Torctite coupler. SEE FIGURE 9.

9) Install Turn Box: See Fig 12B

   - The Turn Box has "long" and "short" tube legs
   - The 'long' leg attaches to the burner-run tubes
   - The 'short' leg attaches to the vent-run tube side - tubes end short of burner for connection of vent pipe

FIGURE 11 'U'-TUBE TYPICAL HANGER & SUPPORT SPACING



SUSPEND FIRST TUBES BY TWO (2) HANGERS, THEN SUBSEQUENT SECTIONS BY ONE HANGER

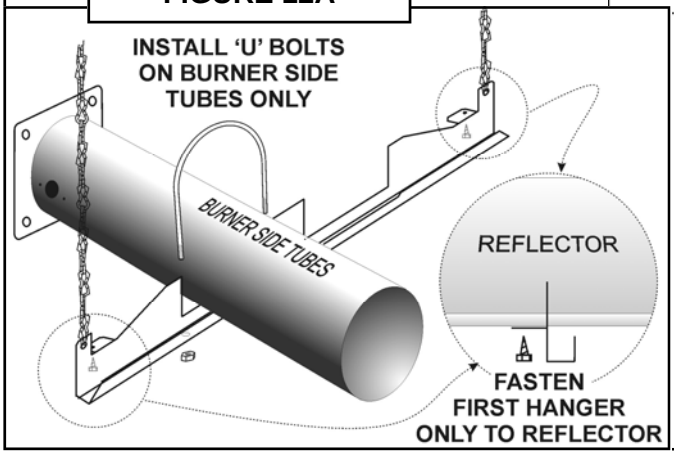
LOCATE HANGERTS BETWEEN 6" to 18" FROM EACH TUBE COUPLER.

INSTALL FIRST AND SECOND TUBES (FROM BURNER END) WITH WELDED SEAM FACING DOWNWARD.

1 - END CAP
2 - WIRE HANGER
3 - BURNER ASSEMBLY
4 - COMBUSTION AIR OPTIONS:
4A - JS-0532-SE 4" INTAKE ADAPTER
4B - JS-0532-VC 4" WALL CAP
4C - JA-0528-XX 4" ROOF CAP
5 - SIGHT GLASS
6 - ALUMINIZED TUBE WITH FLANGE
7 - TORCTITE TUBE COUPLER
8 - STEEL TUBE(S)
9 - REFLECTOR
10 - FLUE VENT TERMINAL
11 - BURNER SUPPORT CHAIN
12 - HANGER SUPPORT CHAINS

FIGURE 12 'U' TUBE MODELS

'U' TUBE HANGER FIGURE 12A



TURN BOX FIGURE 12B

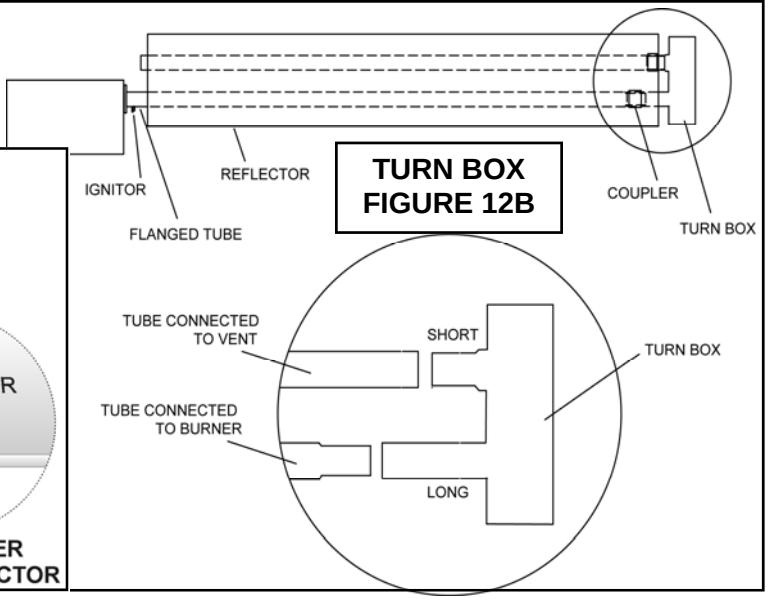
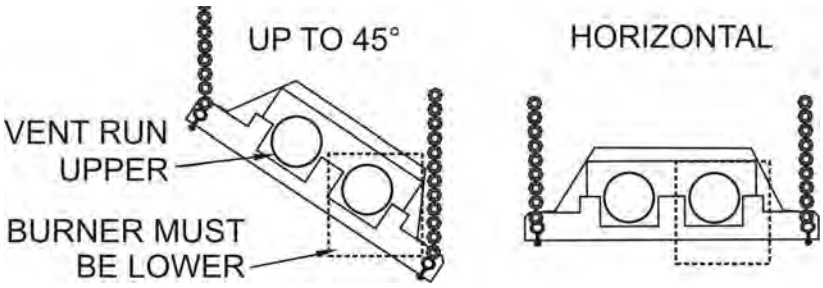


FIGURE 13 'U' TUBE MODEL ORIENTATION



9.3 SPECIAL COUPLING: 175,000 & 200,000 Btuh

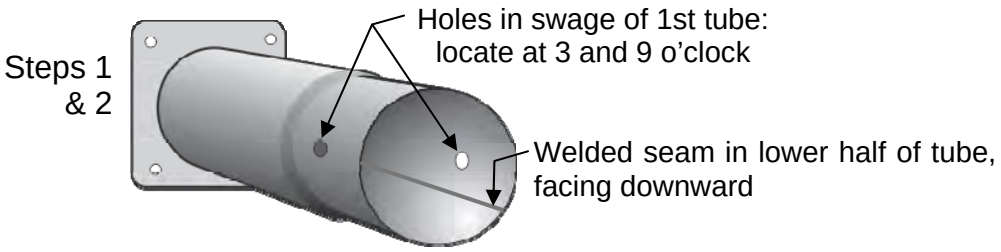
NOTE: The joint of 1ST & 2ND tubes of 175,000 & 200,000 heaters experience strong forces of expansion. Follow instructions below for special coupling of the tubes.

SPECIAL COUPLER INSTALLATION

1. Note the 2 holes opposite each other at the swaged end of the first tube (flanged)
2. Install the **first tube** with 2 holes (swaged end) at the 3 and 9 o'clock position, with the **welded seam located in the lower half of tube, facing downward**
3. Slide the loosened tube coupler on to the first tube, past the swage
4. The second tube has a ¼" hole at the female end.
5. Slide second tube over swaged end of first tube to align the hole in the second tube with one of the holes in the first tube
6. Final alignment of the holes can be accomplished using a screw driver or other tool
7. **IMPORTANT:** Insert ¼" rivet into the hole to secure the tube connection
8. Slide coupler into position – half onto each tube – covering the rivet head
9. Tighten coupler bolts to 40 ft-lb
10. Install reflectors

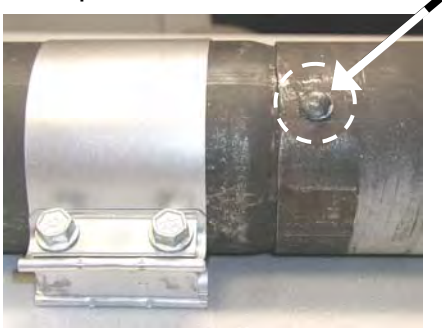
FIGURE 16 SPECIAL COUPLING:

- **175,000 & 200,000 Btuh** - Fasten Second Tube to First Tube -

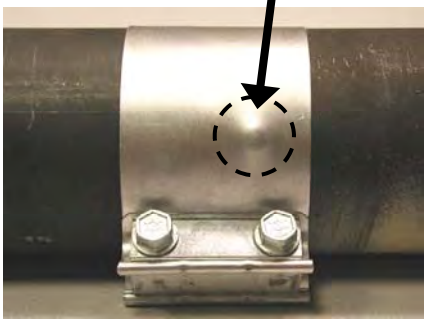


Steps 3 to 6

Step 7



Steps 8 & 9



10. REFLECTOR INSTALLATION

NOTE: Ensure that you are installing a single reflector - reflectors can 'stick together' in packaging - take care to separate them.

SET / ITT - STRAIGHT TUBE: After burner and tubes have been installed, slide the reflectors one at a time into the wire hangers. As each successive reflector is installed on an in-line installation, the ends of the reflectors will overlap to provide continuous coverage over the entire tube system. The overlapping joints **MUST BE FASTENED TOGETHER** with a sheet metal screw.

Note that for either horizontal or angle mounting of the reflector, the tube must be level along its length. Improper mounting can result in overheating of controls and combustible materials.

Reflector extensions can be added to the heaters as an option. *See Figure 15 and instructions next page*

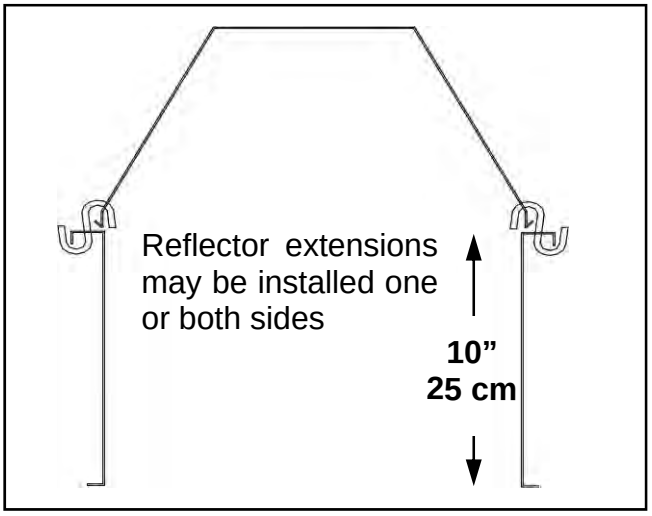
SET-U / ITT-U - 'U'-TUBE: After burner and tubes have been installed, slide the double-wide reflectors one at a time onto the hangers. Fasten the FIRST hanger nearest the burner to the reflector with a sheet metal screw up through the hole in the tab at each end of the hanger.

Do not fasten any other hangers in the system to reflectors. SEE FIGURE 12A

As each successive reflector is installed, the ends of the reflectors will overlap to provide continuous coverage over the entire tube system. The overlapping joints **MUST BE FASTENED TOGETHER** with sheet metal screws - Note that for both horizontal and angle mounting, the tube must be level along its length. Improper mounting can result in overheating of controls and combustible materials.

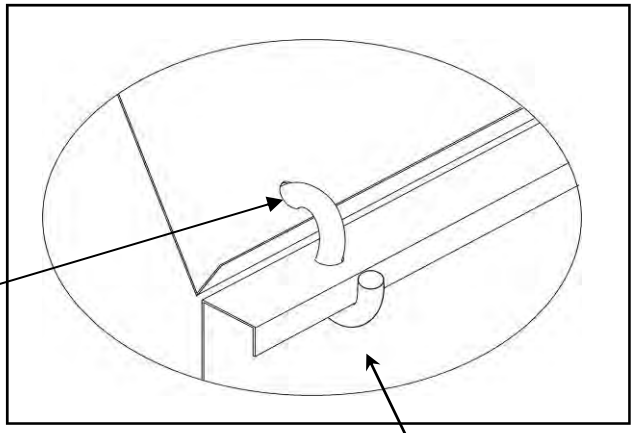
Reflector extensions can be added to the heaters as an option. *See Figure 15 and instructions next page*

FIGURE 15 REFLECTOR EXTENSIONS (OPTIONAL - IF REQUIRED)

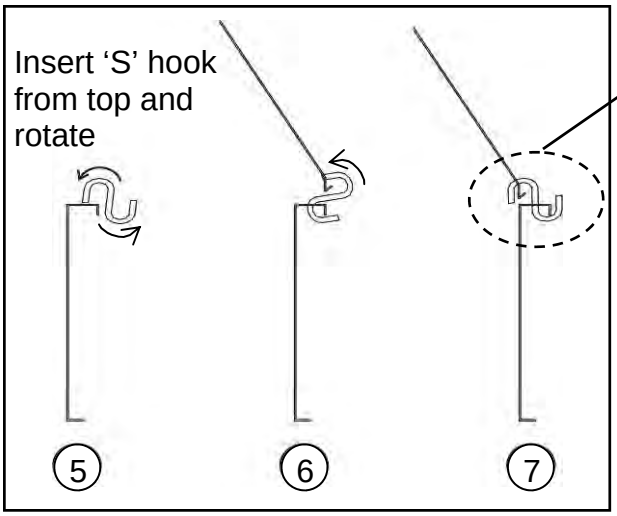


Reflector Extension Kit JS-0509-KT
Includes:

- Qty 1 x 10 ft long x 10 inch deep reflector extension
- Qty 3 x “S” Hooks



1. Reflector extensions may be installed on one side or both sides of the reflector
2. Reflector extensions are 116” (295 cm) long
3. Holes (3) in the reflector extension for “S” hooks are located 2.25” (5.7 cm) from each end and one at the center
4. Drill 1/4” (7 mm) holes in the reflector 3/4” (2 cm) up from the bottom edge of the reflector to align with the 3 holes in the top of the reflector extension
5. Insert “S” hook down through hole in the top of the reflector extension
6. Rotate “S” hook approx. 90°, and insert into hole drilled in reflector
7. Settle reflector extension into place



WARNING

11. FLUE VENTING

Inadequate venting of a heater may result in asphyxiation, carbon monoxide poisoning, injury or death. This heater may use a vent connection or indirect venting system to remove products of combustion from the space. Seal all vent connections with high temperature sealant. Venting must be in accordance with all local, state, provincial, and national codes (ANSI Z223.1/NFPA 54 in USA; B149.1 in Canada) and as indicated below in this manual.

THIS TUBE HEATER IS APPROVED FOR VENTING DIRECTLY TO THE OUTSIDE AND UNVENTED (INDIRECT VENTING) APPLICATIONS. THE SYSTEM MUST NOT BE OPERATED WITHIN A NEGATIVE AIR CONDITION UNLESS COMBUSTION AIR IS DUCTED FROM OUTSIDE DIRECTLY TO THE BURNER.

IF NEGATIVE PRESSURE IS EXPERIENCED OR ANTICIPATED, THE SECOND PORT (BARB) ON THE BLOCKED FLUE SWITCH SHOULD BE CONNECTED DIRECTLY TO OUTSIDE AIR USING 1/4" PLASTIC HOSE FROM BLOCKED FLUE SWITCH TO OUTSIDE OF BUILDING (FIELD SUPPLIED).

UNVENTED (INDIRECT MECHANICAL VENTING SYSTEM)

Indirect venting must not be used if the building experiences a negative air condition. A minimum 10 inch (25 cm) length of single walled vent pipe is to be installed on the swaged end of the last tube before any Tee, Elbow or Termination Cap is fitted.

USA: Natural or mechanical means shall be provided to supply and exhaust at least 4ft^3/min/1000Btuh (0.38m^3/min/kW) input of installed heaters. Some local codes may require an electrical interlock to a dedicated exhaust fan. Exhaust must be located as high as practicable in the structure above the level of the heater(s). Consult your local code and ANSI Z223.1 latest edition for all venting requirements and practices.

Canada: It is required that the heater(s) be electrically interlocked to dedicated exhaust fan(s) by means of an Air Proving Switch. Exhaust fan(s) must be sized to create 300 cfm (8.5 cu m/min) exhaust for every 100,000 Btuh (30 kW) or any fraction thereof of total input of installed equipment. Exhaust must be located as high as practicable in the structure above the level of the heater(s). Sufficient supply air must be provided. Consult the latest edition of CSA.B149.1 Section 8 for venting system and air supply requirements.

VENTED DIRECTLY TO THE OUTSIDE

It is the sole responsibility of the installer to adhere to all current local codes and/or ANSI Z223.1 / CSA.B149.1 latest editions for all venting requirements, and practices.

It is a normal condition that during heat-up and cool-down a tube heater will expand and contract. *Allowances for heater expansion must be made in the venting and combustion air ducting*. Improper installation can result in property damage, injury or death.

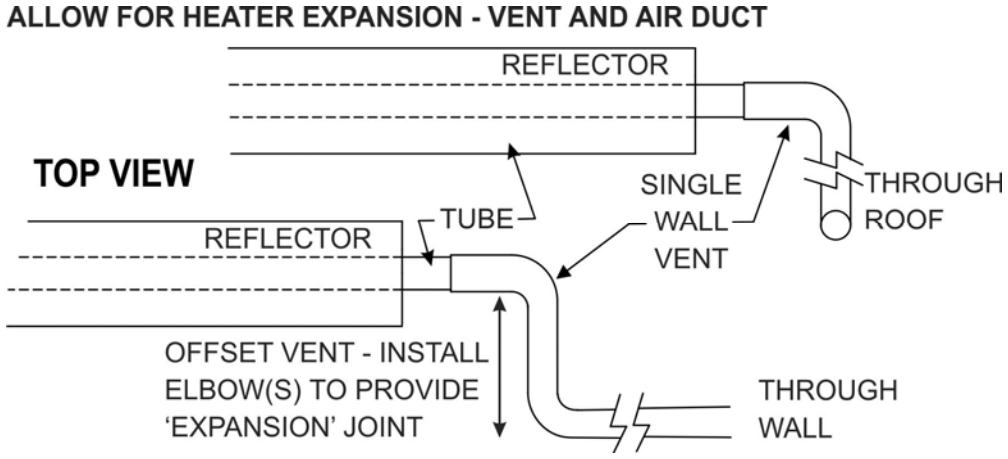
- All vent pipe and adapters are supplied locally by others
- All venting must be minimum 26 gauge single wall vent pipe and 4" (10 cm) diameter except that portion of vent passing through a combustible wall or roof can be 4" type "B" vent as per CSA International's interim requirement. Refer to Section 11A for vent length requirements.
- As an Option, two heaters may be vented through an approved common 4" x 4" x 6" Vent Tee (10 x 10 x 15 cm), supplied by the manufacturer. Vent pipe from each heater does not need to be equidistant to the vent Tee, but must comply to requirements below. The two

heaters must be controlled by a single common thermostat or “ON/OFF” switch.

- Install a minimum 36 inch (91 cm) length of minimum 26 gauge single walled 4” (10 cm) diameter vent pipe on the system, and a minimum 12 inch (30 cm) before any Tee or Elbow.
- Seal all vent connections with high temperature sealant. Vent connections must be secured with three (3) #8 sheet metal screws uniformly spaced around the circumference of the pipe.
- Any horizontal vent pipe must slope approx. 1/4” per foot away from heater
- When the vent pipe passes through a cold or unheated area where the ambient temperature is likely to produce condensation of the flue gases, the vent pipe shall be insulated with a suitable material as approved and specified by the insulation manufacturer to withstand temperature up to 460°F (238°C).
- The vent system must **always** be adequately supported to prevent sagging.

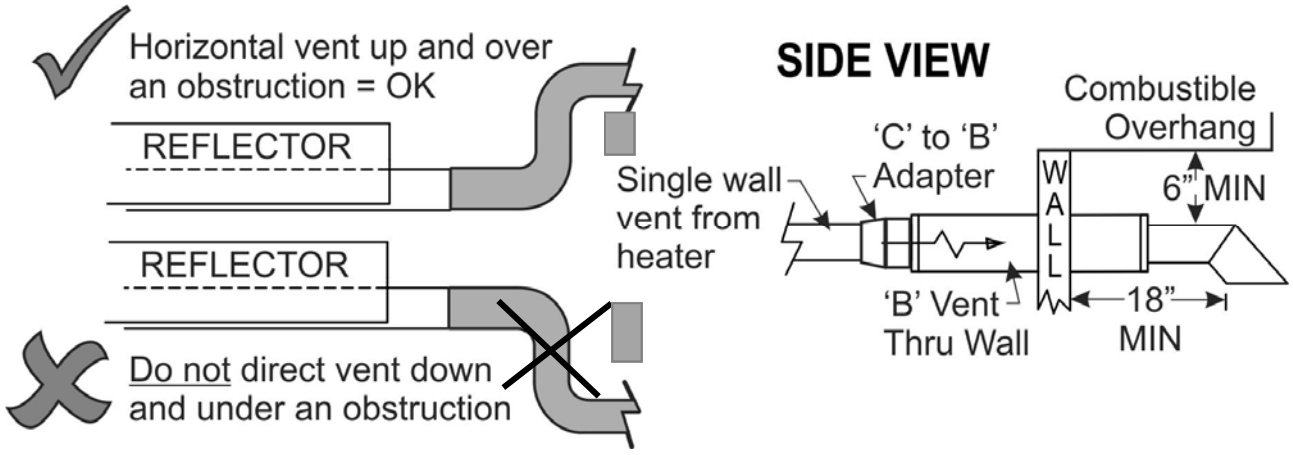
FIGURE 17 - Heater Expansion - Suggested Vent Configuration*

All Vent Pipe & Adapters By Others



* Other means of slip fit installation of the vent and duct are acceptable providing there is adequate allowance for free expansion and contraction of the system, and free flow of vent gases and combustion air.

FIGURE 18- Horizontal Vent - ALL vent pipe and adapters by others



Clearances apply to Vent Terminal: 4” (10 cm) - JA-0528-XX Or 6” (15 cm) - JA-0529-XX

See notes below for use of other approved vent terminations

HORIZONTAL VENT THROUGH THE SIDEWALL:

- Any horizontal portion of the flue vent system must slope downwards approximately 1/4" per foot (63 mm/ 300 mm) toward the vent terminal - radiant tube must be level.

- Use approved 4" (10 cm) (JA-0528-XX) or 6" (15 cm) (JA-0529-XX) horizontal wall vent terminal or a high-wind termination cap approved by a recognized certification agency
- Install termination cap a minimum of 18 inches (45 cm) from the outside wall to the inside edge of terminal opening to alleviate back pressure caused by turbulent wind conditions (See Fig. 21). This also ensures flue gases are directed away from the structure to protect building materials from degradation by the exhausted flue gases.
- At most two 90° elbows can be installed in a horizontal vent
- Installation of the vent must prevent blockage by snow and protect building materials from degradation by flue gases.

A horizontal flue vent :

- Will not terminate less than 1 ft (30 cm) above grade level, unless its location is adjacent to public walkways, then it must not terminate less than 7 ft (2.1m) above the walkway.
- Below a combustible overhang or soffit:
  - As indicated in FIGURE 21 for approved terminations: 4" (10 cm) JA-0528-XX or 6" (15 cm) JA-0529-XX
  - For other approved terminations: Will terminate 3 ft (90 cm) or more below a combustible soffit or overhang.

- **USA** specific horizontal vent requirements:
  - The vent terminal of a direct-vent appliance with an input between 10,000 Btu/hr (3 kW) and 50,000 Btu/hr (14.7kW) shall be installed with a 9 inch (230mm) vent termination clearance from any air opening into a building, and an appliance with an input over 50,000 Btu/hr (14.7kW) shall have at least a 12inch (300mm) vent termination clearance. The bottom of the vent terminal and the air intake shall be located at least 12inches (300mm) above grade.
  - A horizontal vent will not terminate:
    - Less than 3 ft (90 cm) above a mechanical air inlet located within 10 ft (3.1 m)
    - Less than 4 ft (1.2 m) below, 4 ft (1.2 m) horizontally from, and 1 ft (0.3 m) above any window or door that opens, or gravity air inlet to a building
    - Less than 4 ft (1.2 m) horizontal clearance from gas and electric meters, regulators and relief equipment

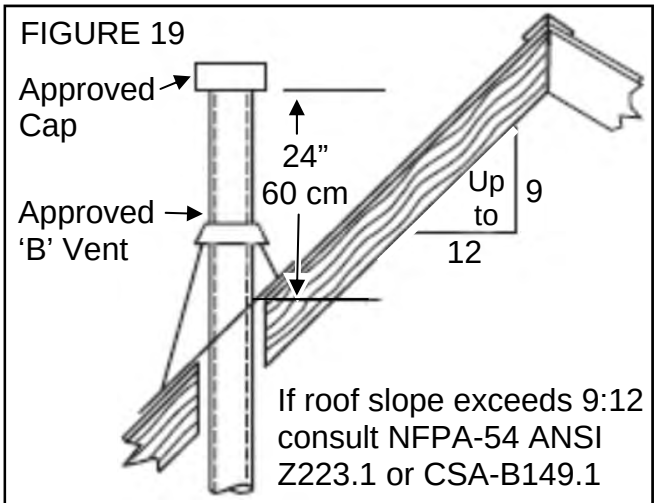
- **CANADA** specific horizontal vent requirements:
  - A horizontal vent will not terminate:
    - Within 6 ft (1.8 m) of a mechanical air supply inlet to any building.
    - Above a gas utility meter and regulator assembly within 3 ft (0.9 m) horizontally of the vertical centerline of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m).
    - Within 3 ft (90 cm) of any gas pressure regulator vent outlet
    - Within the following distances of a window or door that can be opened in any building, of any non-mechanical air-supply inlet to any building, or of the combustion air inlet of any other appliance:
      - 12 inches (30 cm) for inputs up to and including 100,000 Btuh (30 kW)
      - 3 ft (90 cm) for inputs exceeding 100,000 Btuh (30 kW)

VERTICAL VENT THROUGH THE ROOF:

It is the sole responsibility of the installer to adhere to all current local codes and/or ANSI Z223.1 / CSA.B149.1 latest editions for all venting requirements, and practices.

- Use an approved 'B-vent' termination cap as supplied by the manufacturer of the approved 'B-vent'.
- When vent and combustion air are taken through the roof, the exhaust vent should always terminate higher than the combustion air intake, to prevent recycling the products of combustion back into the heater.

FIGURE 19



11A. Combined System Length: Tube Heater + Vent + Combustion Air Duct:

MINIMUM VENT LENGTH: (Vented or Unvented)

- Minimum vent length of 3 ft x 4" [91 cm x 100 mm] diameter is required

MAXIMUM SYSTEM LENGTH (includes: Tube Heater length + combustion air duct + vent**)**:

- Each 90° elbow in the system has an equivalent length of 5 ft (air duct, tube, or vent pipe).
- A maximum of 2 elbows are allowed in any portion of air duct, tube heater, vent pipe, with the exception of up to three 90° elbows in a vertical vent run through the roof
- Vent pipe diameter shall be 4" [100 mm] for a single heater, or 6" [150 mm] combined vent for two heaters - do not substitute any other vent diameter
- The maximum length of combustion air duct to any heater is not to exceed 30 feet of 4 inch [100 mm] diameter duct or 50 ft x 5" diameter duct
- Exceeding the allowable lengths in the table below can create combustion and/or condensation issues and will void CSA Design Certification and the heater warranty.

Input (Btuh)	Do Not Exceed Max. Combined System Length*		Max. Vent Length* Individual: 4" Ø Combined: 6" Ø	Max. Air Duct Length* (by Duct Diameter)	
	4" Air Duct	5" Air Duct		4" Ø	5" Ø
80 / 60,000	**80 ft**	**100 ft**	Up to 40 ft	30 ft	50 ft
110 / 75,000	**100 ft**	**120 ft**	Up to 40 ft	30 ft	50 ft
130 / 90,000	**100 ft**	**120 ft**	Up to 40 ft	30 ft	50 ft
155 / 110,000	**100 ft**	**120 ft**	Up to 40 ft	30 ft	50 ft
175 / 125,000	**120 ft**	**140 ft**	Up to 50 ft	30 ft	50 ft
200 / 140,000	**120 ft**	**140 ft**	Up to 50 ft	30 ft	50 ft

Example	
155/110,000 Btuh Heater:	
Tube Heater Length	50 ft
1 x 90° elbow (vent)	5 ft
Straight vent	20 ft
1 x 90° elbow (duct)	5 ft
Air Duct: 4" Ø	17 ft
Combined Length	97 ft
Max. Allowed	100 ft

* Regardless of the allowed maximum length of the individual vent or combustion air duct, **do not exceed the Maximum Combined System Length** which includes the length of the tube heater plus the air duct and the vent.

12. COMBUSTION AIR DUCTING

Do not install filters on the combustion air intake. Ensure adequate clearance around the air intake to allow sufficient combustion air supply to the heater.

This heater requires optional 4" Fresh Air Intake Adapter JS-0532-SE to connect an outside combustion air duct.

An opening is located on the top surface of the burner housing for combustion air . Ensure adequate clearance around this opening to allow sufficient combustion air supply to the heater. Combustion air duct must be constructed of noncombustible material.

When a tube heater is operated in a negative air condition or air-born dust or contaminants are present as in woodworking and welding shops, air for combustion must be ducted from outside the negative or contaminated area to the 4 inch (10 cm) diameter intake flange supplied on the blower. Maximum system, vent and duct length is listed above.

- The total system length and individual flue vent or the combustion air duct is not to exceed the lengths listed above
- Total combined system length is reduced by five feet for every 90° elbow installed in the vent or duct *and* in the tube system (see above for allowable total lengths)
- Exceeding the allowable lengths may create condensation or soot conditions and will void CSA Design Certification and product warranty

The air intake will not be located less than:

- Three feet above grade
- Twelve inches from flue vent terminal of any heater with input up to 100,000 Btu/hr
- Three feet from flue vent terminal of any heater over 100,000 Btu/hr

This heater has an optional fresh air intake duct hood for wall (JS-0532-VC) or roof cap (JS-0530-XX) to bring combustion air to the heater from outside. Ensure adequate clearance around the air intake to allow sufficient combustion air supply to the heater. If drawing fresh air from outside, it is recommended that any single wall pipe containing cold air be insulated to prevent or reduce condensation on the pipe.

Do not use flexible dryer hose or any 'soft wall' tubing for air inlet duct, the corrugated sides of this tubing restrict air flow. A good quality industry approved insulated flex is allowed.

CAUTION:

In locations where chlorinated Hydrocarbons are in use, such as Trichloroethylene or Chloroethylene Nu it is essential that combustion air be brought in from a non-contaminated area. Burning the fumes from these gases will create Hydrochloric acid fumes, which are detrimental to humans, equipment and buildings. Typical sources of other contaminants are paint removers, paints, refrigerants, solvents, adhesives, degreasers, lubricants, pesticides, etc.

The heater manufacturer cannot anticipate all types and chemical composition of possible contaminants at project sites. Confer with project site safety, health and engineering staff and/or local authorities having jurisdiction such as the Fire Marshall and Department of Labor for possible contaminants and any conflict with the installation of hot surface heating equipment.

13. GAS SUPPLY - HEATER EXPANSION - FLEXIBLE GAS CONNECTION

The gas supply must be installed to the heater using:

- **USA**: an approved Stainless Steel Flexible Gas Connector certified for use on an infrared radiant tube heater (ANSI Z21.24 CSA 6.10);
- **CANADA**: an approved Type 1 Hose Gas Connector (CAN/CGA 8.1).
- The heater must be isolated from the gas supply piping system by closing its individual manual shut off valve (field supplied) during any pressure testing of the gas supply piping system.

CAUTION: Compensation for normal gas supply pipe expansion, and radiant tube heater expansion must be provided. All piping must conform to local codes— Refer to Heater Expansion & Flexible Gas Connection—Sections 14 next two pages

Provide a 1/8 in (3.2 mm) NPT plugged tapping, accessible for test gauge connection, immediately upstream of the gas supply connection to the heater.

DO NOT use pressure greater than 1/2 psig to pressure check the heater.

TEST FOR LEAKS: All gas piping and connections must be tested for leaks after the installation is completed.

Apply soap suds solution to all connections and joints and if bubbles appear, leaks have been detected and must be corrected. **DO NOT USE A MATCH OR OPEN FLAME OF ANY KIND TO TEST FOR LEAKS. NEVER OPERATE THE HEATER WITH LEAKING CONNECTIONS.**

The supply system should be checked first with heater turned “OFF” followed by another check with heater turned “ON”.

IMPORTANT: Minimum supply line pressure at the inlet to the heater regulator must not be lower than 5.0 inches of water column pressure for natural gas. The supply gas pressure must be checked with all heaters in operation.

Installation of a gas line (trap) “drip leg” is required at the inlet connection tee following the pipe drop to the heater. Failure to provide a “drip leg” could result in condensation and foreign matter passing into the gas valve. Failure to install a “drip leg” in the gas line can cause property damage, injury or death and will void the heater warranty.

TABLE 4

GAS TYPE	LINE PRESSURE INCHES WATER COLUMN		MANIFOLD PRESSURE (tap at gas valve outlet) INCHES WATER COLUMN
	MINIMUM	MAXIMUM	
Natural Gas	5.0	14.0	3.5

NOTE: Access to the manifold pressure test port is on the top of the valve. A 3/16" Allen Wrench is necessary to check this. When checking or setting the manifold pressure, a **water manometer** should be used. Gauges which measure in ounces per square inch or pounds per square inch are not accurate enough to properly measure or set the pressure.

WARNING

THIS HEATER WILL EXPAND IN LENGTH AS IT HEATS UP. It is a normal condition that during heat-up and cool-down a tube heater will expand and contract. Allowances for heater expansion must be made in the gas connection, venting and combustion air ducting. Improper installation, alteration, or adjustment can result in property damage, injury or death. **See also Section 13**

The Btuh input and the tube length determine the overall expansion that occurs. A typical infrared tube installation will expand toward both the Burner and the vent end.

To allow heater expansion the gas supply must be installed using the flexible gas connector supplied in the burner kit:

In the USA: a stainless steel Flexible Gas Connector certified for use on an infrared radiant tube heater (ANSI Z21.24 CSA 6.10);

in CANADA: a Type 1 Hose Connector (CAN/CGA 8.1). Also the flue vent, and combustion air intake (if used) must be installed in such a manner that the normal expansion of the heater will be accommodated.

IMPORTANT: See next page: orientation of connection between heater and gas supply.

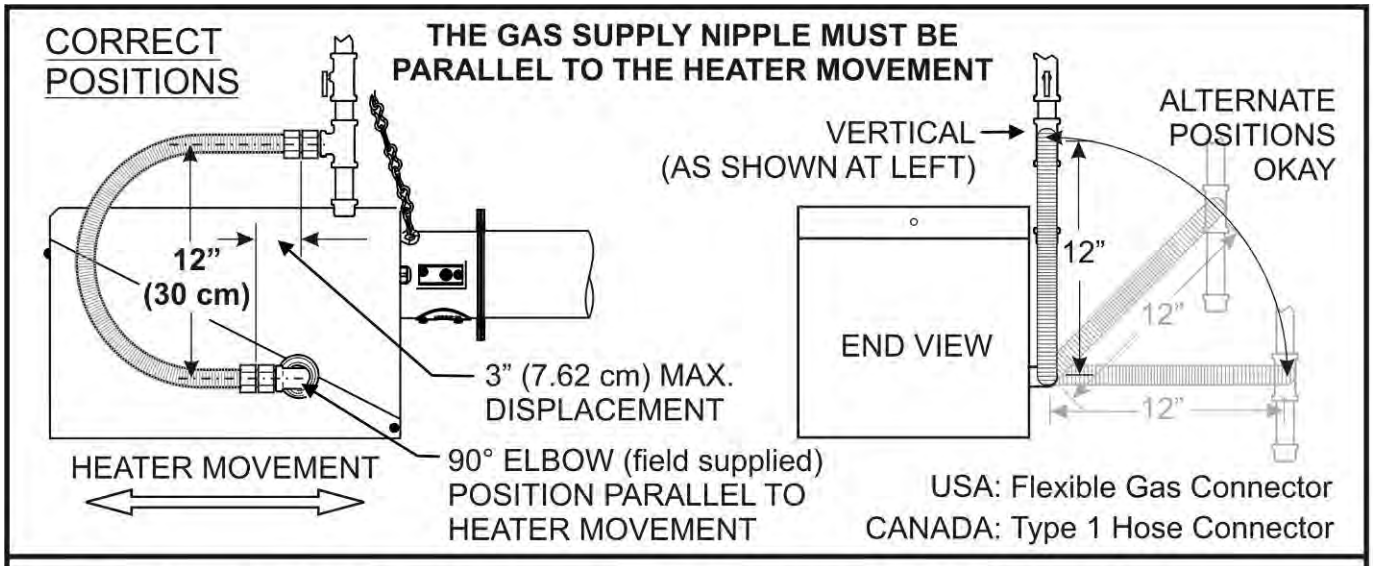
TABLE 5

High-Fire Input Btuh	Tube Length Feet	Approx. Expansion in Length	USA: Mandatory Flexible Gas Connector ID x Length - Part #	CANADA: Mandatory Type '1' Gas Hose Size - Part #
80,000	20 / 30	1 3/4"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
100,000	20	2"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
110,000	30 / 40	2"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
130,000	30 / 40	2"	1/2" x 24" - JL-0771-XX	1/2" x 36" - JL-0771-RC
155,000	40 / 50	2 1/2"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB
175,000	50 / 60	2 3/4"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB
200,000	50	2 3/4"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB
200,000	60	3 1/4"	3/4" x 36" - JL-0771-YY	3/4" x 36" - JL-0771-RB

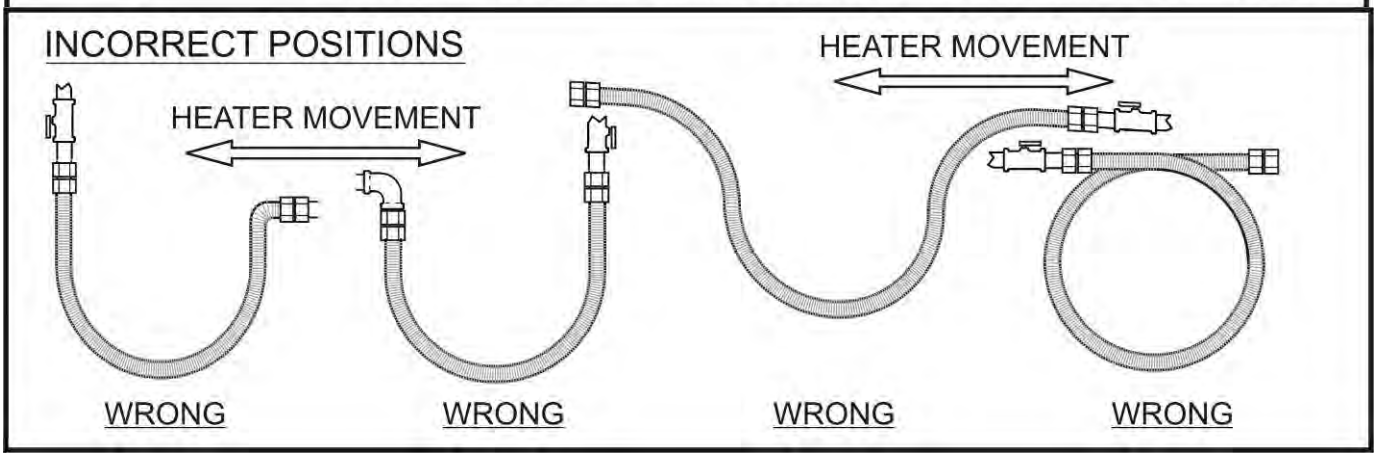
FIGURE 20 ORIENTATION OF FLEXIBLE GAS CONNECTOR

The flexible gas connector MUST be installed in the orientation shown below as required by national installation codes and by the certification standard of this heater. This orientation protects the flexible gas connector from damage due to movement during heater expansion.

It is the responsibility of the installer to ensure correct installation of the flexible gas supply.



WARNING: CONNECTOR MUST BE INSTALLED IN " ⊂ " CONFIGURATION. USE ONLY THE CONNECTOR OF PROPER LENGTH AND NOMINAL ID THAT IS FURNISHED WITH THIS HEATER - SEE TABLE PREVIOUS PAGE.



The flue vent, and combustion air duct (if installed) must also be configured in such a manner that the normal expansion of the heater will be accommodated. **See Section 11.**

14. ELECTRICAL AND THERMOSTAT WIRING (WIRING DIAGRAMS PAGE 35 & 36, 52)

NOTICE

The heater must be electrically grounded in accordance with the National Electrical Code. ANSI / NFPA 70 or current Canadian Electrical code CSA C22.1.

Appliance and control wiring must be in accordance with all applicable local codes. The total load of all heaters must be considered in determining the required contact rating of the controlling thermostat or switch. Each tube heater requires 120V, 60 HZ electrical power sized for 145VA. The heater includes a 24V/120V relay switch and is to be controlled by a Honeywell FocusPRO 5000 Series TH5220D1037 (or equivalent) 24V Digital Thermostat - Schwank/ InfraSave P/N JS-0569-DT. Maximum power flow for internal 24V burner components is 21VA.

A maximum night set-back of 9°F (5°C) is recommended for optimum economy and comfort. To maintain satisfactory comfort levels do not turn off the heating system over night/weekends.

15. HIGH ALTITUDE INSTALLATIONS - *also refer to chart in Section 28*

When this appliance is installed above the altitude stipulated below for the USA or Canada, the input must be de-rated by 4% for each 1000 ft above the altitude listed . **If your local utility supplies gas with a de-rated heat content, no orifice change is required in the heater** . If the gas supply is not de-rated, the orifice must be changed according to the chart in Section 28. Check with your local utility regarding the gas supply and the de-rating of this appliance.

USA: The factory installed orifice for this appliance is approved for altitudes zero to 2000 feet above sea level. When installed above 2000 feet, **refer to Section 28**.

Canada: The factory installed orifice for this appliance is approved for altitudes zero to 4500 feet above sea level. When installed above 4500 feet, **refer to Section 28**.

16. LIGHTING INSTRUCTIONS

Refer to the lighting instructions label on the outside of the burner housing. If the unit locks out on safety, main power to the unit must be manually interrupted for a 30 second reset period before the heater can be restarted.

NOTE: ***On initial installation, the unit may lock out on safety owing to the length of time required to bleed air from the gas piping system.***

17. RECOMMENDED MAINTENANCE

Improper adjustment, alteration, service or maintenance can cause property damage, injury or death. This heater must be installed and serviced only by a trained gas service technician.

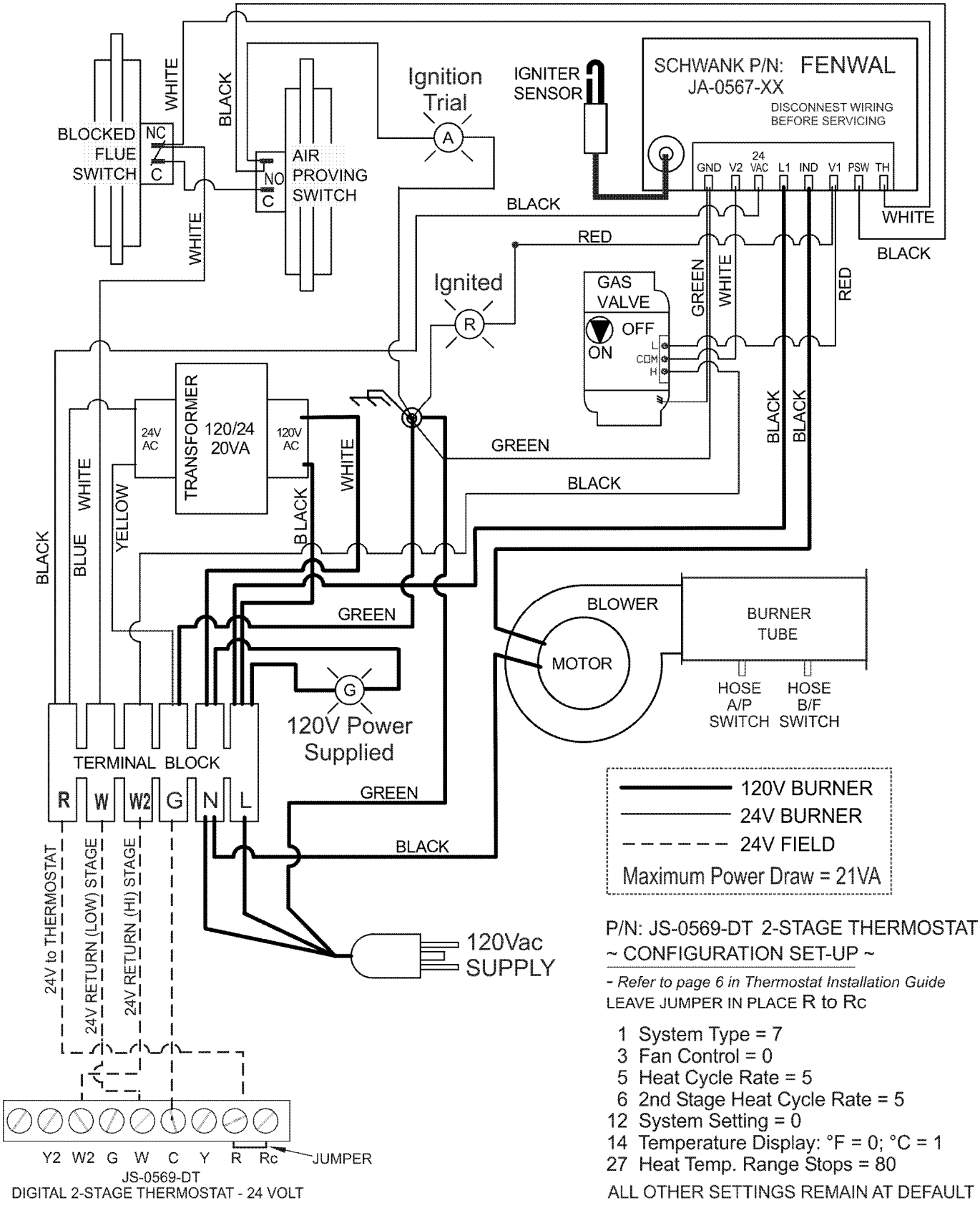
1. Inspect the entire heater system, venting, and gas supply connections at least annually prior to the heating season. Replace worn parts and repair deficiencies.
2. Check the inlet air opening and the blower periodically, cleaning off any lint or foreign matter. It is important that the flow of combustion and ventilation air must not be obstructed.
3. Lubricate Blower motor, by adding several drops of oil to oil ports located on the left hand side of the motor.

THE TUBE HEATER BURNER IS COMPLETELY FACTORY ASSEMBLED AND TESTED. ANY ALTERATION VOIDS THE CSA CERTIFICATION AND MANUFACTURER'S WARRANTY. FOR ADDITIONAL INFORMATION, CONTACT YOUR LOCAL DISTRIBUTOR OR MANUFACTURER.

18. WIRING DIAGRAM FENWAL DSI *(HONEYWELL S87J - PAGE 52)*

24 VOLT TWO STAGE GAS VALVE – USING 24V TWO STAGE THERMOSTAT

(FOR MULTIPLE HEATERS PER THERMOSTAT SEE NEXT PAGE)



P/N: JS-0569-DT 2-STAGE THERMOSTAT

~ CONFIGURATION SET-UP ~

- Refer to page 6 in Thermostat Installation Guide

LEAVE JUMPER IN PLACE R to Rc

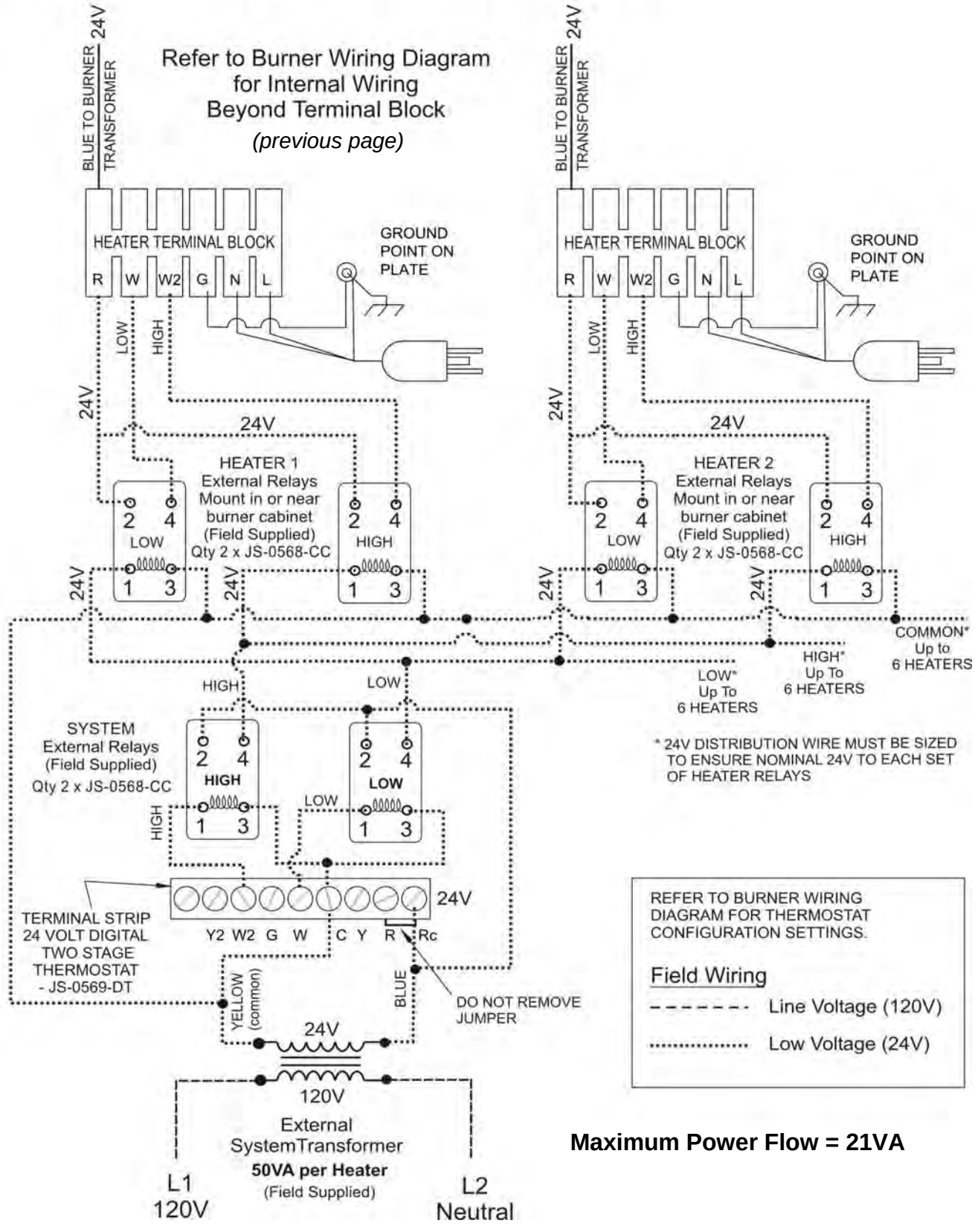
1 System Type = 7
3 Fan Control = 0
5 Heat Cycle Rate = 5
6 2nd Stage Heat Cycle Rate = 5
12 System Setting = 0
14 Temperature Display: °F = 0; °C = 1
27 Heat Temp. Range Stops = 80

ALL OTHER SETTINGS REMAIN AT DEFAULT

19. WIRING DIAGRAM - MULTIPLE 2-STAGE HEATERS PER 2-STAGE THERMOSTAT

(FOR SINGLE HEATER PER THERMOSTAT SEE PREVIOUS PAGE)

Centrally locate thermostat between heaters or in heater zone



Maximum Power Flow = 21VA

20. FENWAL DSI: SEQUENCE OF OPERATION / FLAME RECOVERY / SAFETY LOCKOUT

Power Up / Stand By

Upon applying 24 volts power to 24VAC, the control will reset, perform a self check routine, initiate full time flame sensing, flash the diagnostic LED for up to four seconds, and enter the thermostat scan state.

Heat Mode

When a call for heat is received from the thermostat supplying 24 volts to TH, the control checks the pressure switch for normally open contacts. The combustion blower is then energized and once the pressure switch contacts close, a 30 second purge delay begins. Following the purge period the gas valve is energized and spark commences for the 15 second trial for ignition.

When flame is detected during the trial for ignition, spark is shutoff immediately and the gas valve combustion blower remains energized. The thermostat, pressure switch, and main burner flame are constantly monitored to assure the system continues to operate properly. When the thermostat is satisfied and the demand for heat ends, the main valve is de-energized immediately, the control senses the loss of flame signal and initiates a 30 second post-purge period before de-energizing the combustion blower.

Failure to Light - Lockout (THREE TRIAL MODEL)

This three-try control will attempt two additional ignition trials with a 30 second inter-purge between trials, before going into 'soft' lockout. The valve relay will be de-energized immediately, and the combustion blower will be turned off following the 30 second post purge period.

If the thermostat continues to call for heat after one hour the control will automatically reset and attempt to ignite the burner again (three trials).

At any time less than the 1 hour auto-reset, recovery from lockout requires a manual reset by either resetting the thermostat or removing 24 volts for a period of 5 seconds.

Flame Failure - Re-Ignition

If the established flame signal is lost while the burner is operating, the control will respond within 0.8 seconds. The HV spark will be energized for a trial ignition period in an attempt to relight the burner. If the burner does not light the control will de-energize the gas valve. Two more attempts will be made to relight the burner. If the burner does not relight the control will go into 'soft' lockout as noted above in "Failure to Light". If flame is re-established, normal operation resumes.

Combustion Airflow Problems -Lockout

Combustion air flow is continually monitored during an ignition sequence by the air flow switch (PSW). If during the initial call for heat the pressure contacts are in the closed position for 30 seconds without an output to the Combustion Blower, an air flow fault will be declared and the control will remain in this mode with the combustion blower off.

If the air flow switch remains open for more than 30 seconds after the combustion blower output (L1 & IND) is energized, an air flow fault will be declared and the control will stay in this mode with the combustion blower on, waiting for the air flow switch to close.

When proper air flow is detected from the air flow switch input (PSW) the control begins the pre-purge period followed with a 15 second ignition sequence.

If the air flow signal is lost while the burner is firing, the control will immediately de-energize the gas valve and the combustion blower will remain on. If the call for heat remains, the control will wait for proper air flow to return. If proper air flow is not detected after 30 seconds an air flow fault signal will be declared. If proper air flow is detected at any time, a normal sequence will be-

Flame Fault

If at any time the main valve fails to close completely and maintains a flame, the full time flame sense circuit will detect it and energize the combustion blower. Should the main valve later close completely removing the flame signal, the combustion blower will power off following the optional post purge period.

Fault Conditions

The LED will flash on for 1/4 second, then off for 1/4 second during a fault condition. The pause between fault codes is 3 seconds.

Error Mode	LED Indication
Internal Control Failure	Steady on
Air Flow Fault	1 flash
Flame with No Call for heat	2 flashes
Ignition Lockout	3 flashes

MOUNTING AND WIRING

The Series 35-61 is not position sensitive and can be mounted vertically or horizontally. The case may be mounted on any surface with #6 sheet metal screws. All wiring must be done in accordance with local and national electrical code. Refer to wire diagram page 35 when connecting the Series 35-61 to other components in the burner.

WARNING

The Series 35-61 DSI Control uses voltages of shock hazard potential. Wiring and initial operation must be done by a qualified service technician. The control must be secured in an area that will experience a minimum of vibration and remain below the operating temperature of 160ºF. All connections should be made with UL approved 105ºC rated 18 gauge, stranded, .054 thick insulated wire. Refer to wire diagram page 35 when connecting the Series 35-61 to other components in the burner.

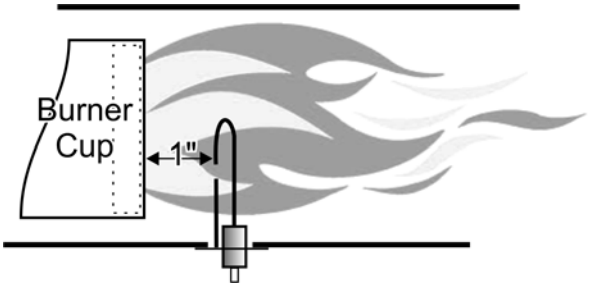
TERMINAL	SPADE	DESIGNATION
TH	1/4”	Thermostat Input
PSW	1/4”	Pressure Switch Input
V1	1/8”	Valve Power (MV)
IND	1/4”	Inducer Blower Output
NC	-	Alarm (Not used)
L1	1/4”	120/240 VAC Input (Hot)
24 VAC	1/4”	24 VAC Supply to Processor
V2	1/8”	Valve (MV)
GND	1/8”	Valve & System Ground
Spark	1/4”	Spark & Local Flame Sense

CAUTION:

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. A functional checkout of a replacement control is recommended.

PROPER ELECTRODE LOCATION

Proper location of the electrode assembly is important for optimum system performance. The electrode assembly should be located so that the spark gap is inside the flame envelope about 1 inch (2.5 cm) from the base of the flame at the burner cup.



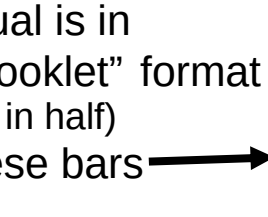
Electrodes should have a gap spacing of 3/16” (0.188” ± 0.031” or 4.76 mm ± 0.81 mm). If this spacing is not correct, the assembly must be adjusted or replaced. DO NOT adjust the curved igniter/sensor prong. Adjust/bend only the ground prong (also see next page).

SPARK IGNITER ADJUSTMENT

Use the following diagram to check the Igniter gap. If the gap is incorrect all adjustments should be made to the **GROUND PRONG/PIN ONLY! DO NOT BEND THE IGNITER PRONG!!!!**

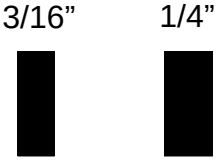
USE THE BLACK BARS BELOW AS A GUIDE FOR ADJUSTMENT. USE THE BARS THAT COINCIDE WITH THE FORMAT & SIZE OF THIS PUBLICATION .

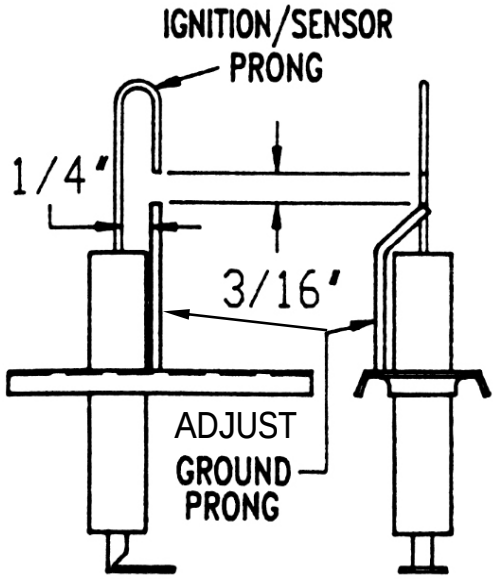
IF this manual is in **8.5" x 11"** "booklet" format (pages folded in half) then use these bars



OR

IF this manual is printed 8.5" x 11" "**full page**" format use these bars



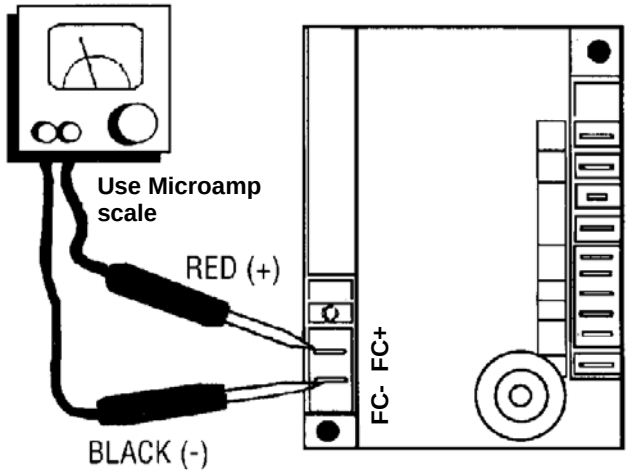


SERVICE CHECKS

Flame current passes through the flame from the sensor to ground. The minimum flame current necessary to keep the system from lockout is 0.7 microamps. To measure flame current, connect an analog DC microammeter to the FC- FC+ terminals per figure at right.

Meter should read 0.7 µA or higher. If the meter reads below "0" on scale, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.

Multipurpose Meter



21. TROUBLESHOOTING GUIDE - FENWAL DSI

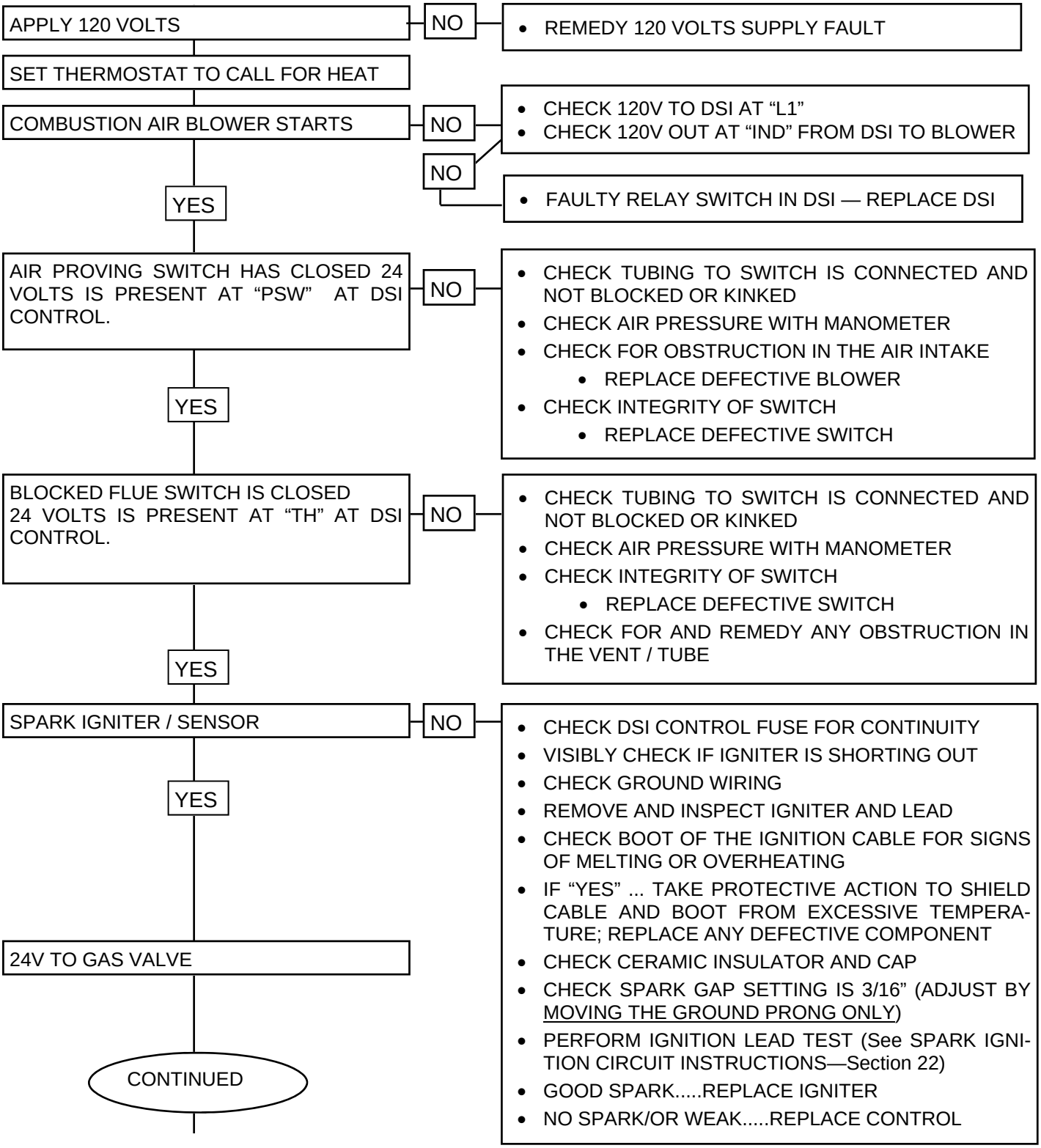
(also see Heater Troubleshooting next page)

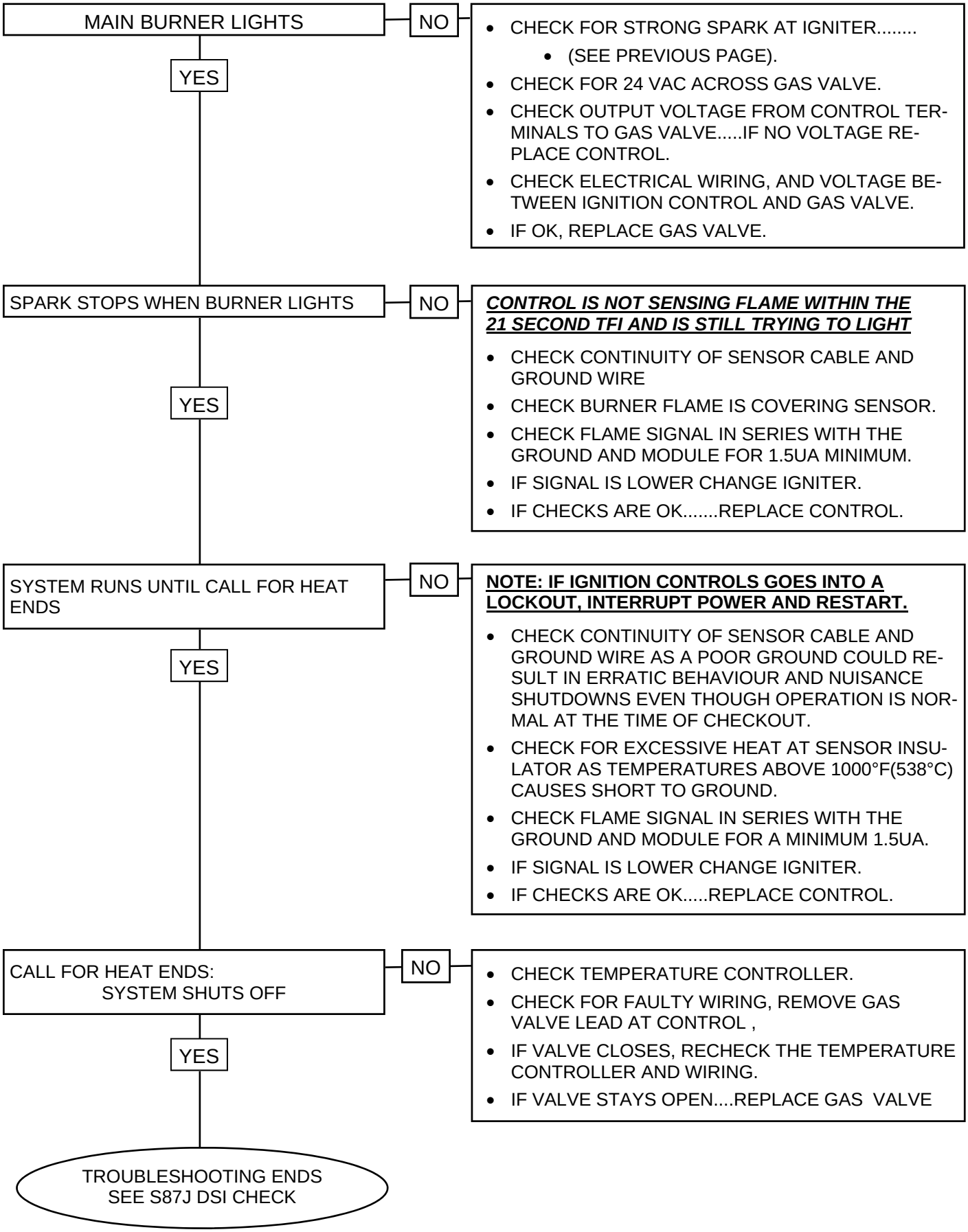
SYMPTOM	RECOMMENDED ACTION(S)
1. Dead	A. Miswired - check electrical supply (120Vac ± 5%) B. Transformer bad (24Vac ± 10%) C. Fuse/Circuit breaker bad D. Bad control (check LED for steady on)
2. Thermostat on - no blower output	A. Miswired B. Bad thermostat no voltage @ terminal W C. Bad control (check LED for steady on)
3. Pressure switch input okay, but no Trial-for-Ignition after purge delay	A. Miswired (check PSW terminal voltage: 24Vac ± 10%) B. Flame sense problem (existing flame: check LED - 2 flashes) C. Bad control (check line voltage between L1 & IND)
4. Valve on, no spark	A. Shorted electrode B. Open HV cable C. Bad control
5. Spark on, no valve	A. Valve coil open B. Open valve wire C. Bad control (check 24Vac voltage between V1 & V2)
6. Flame ok during TFI, no flame sense (after TFI)	A. Bad electrode B. Bad HV igniter wire C. Poor ground at burner D. Poor flame (check flame current)

22. TROUBLESHOOTING GUIDE - HEATER OPERATION

WARNING Improper adjustment, alteration, service or maintenance can cause property damage, injury or death. This heater must be

SEQUENCE OF EVENTS *(also see DSI Troubleshooting previous page)*


APPLY 120 VOLTS
NO
• REMEDY 120 VOLTS SUPPLY FAULT
SET THERMOSTAT TO CALL FOR HEAT
COMBUSTION AIR BLOWER STARTS
NO
• CHECK 120V TO DSI AT "L1"
• CHECK 120V OUT AT "IND" FROM DSI TO BLOWER
NO
• FAULTY RELAY SWITCH IN DSI — REPLACE DSI
YES
AIR PROVING SWITCH HAS CLOSED 24 VOLTS IS PRESENT AT "PSW" AT DSI CONTROL.
NO
• CHECK TUBING TO SWITCH IS CONNECTED AND NOT BLOCKED OR KINKED
• CHECK AIR PRESSURE WITH MANOMETER
• CHECK FOR OBSTRUCTION IN THE AIR INTAKE
• REPLACE DEFECTIVE BLOWER
• CHECK INTEGRITY OF SWITCH
• REPLACE DEFECTIVE SWITCH
YES
BLOCKED FLUE SWITCH IS CLOSED 24 VOLTS IS PRESENT AT "TH" AT DSI CONTROL.
NO
• CHECK TUBING TO SWITCH IS CONNECTED AND NOT BLOCKED OR KINKED
• CHECK AIR PRESSURE WITH MANOMETER
• CHECK INTEGRITY OF SWITCH
• REPLACE DEFECTIVE SWITCH
• CHECK FOR AND REMEDY ANY OBSTRUCTION IN THE VENT / TUBE
YES
SPARK IGNITER / SENSOR
NO
• CHECK DSI CONTROL FUSE FOR CONTINUITY
• VISIBLY CHECK IF IGNITER IS SHORTING OUT
• CHECK GROUND WIRING
• REMOVE AND INSPECT IGNITER AND LEAD
• CHECK BOOT OF THE IGNITION CABLE FOR SIGNS OF MELTING OR OVERHEATING
• IF "YES" ... TAKE PROTECTIVE ACTION TO SHIELD CABLE AND BOOT FROM EXCESSIVE TEMPERATURE; REPLACE ANY DEFECTIVE COMPONENT
• CHECK CERAMIC INSULATOR AND CAP
• CHECK SPARK GAP SETTING IS 3/16" (ADJUST BY MOVING THE GROUND PRONG ONLY)
• PERFORM IGNITION LEAD TEST (See SPARK IGNITION CIRCUIT INSTRUCTIONS—Section 22)
• GOOD SPARK.....REPLACE IGNITER
• NO SPARK/OR WEAK.....REPLACE CONTROL
YES
24V TO GAS VALVE
CONTINUED


MAIN BURNER LIGHTS
NO
YES
CHECK FOR STRONG SPARK AT IGNITER.....
(SEE PREVIOUS PAGE).
CHECK FOR 24 VAC ACROSS GAS VALVE.
CHECK OUTPUT VOLTAGE FROM CONTROL TERMINALS TO GAS VALVE.....IF NO VOLTAGE REPLACE CONTROL.
CHECK ELECTRICAL WIRING, AND VOLTAGE BETWEEN IGNITION CONTROL AND GAS VALVE.
IF OK, REPLACE GAS VALVE.
SPARK STOPS WHEN BURNER LIGHTS
NO
YES
CONTROL IS NOT SENSING FLAME WITHIN THE 21 SECOND TFI AND IS STILL TRYING TO LIGHT
CHECK CONTINUITY OF SENSOR CABLE AND GROUND WIRE
CHECK BURNER FLAME IS COVERING SENSOR.
CHECK FLAME SIGNAL IN SERIES WITH THE GROUND AND MODULE FOR 1.5UA MINIMUM.
IF SIGNAL IS LOWER CHANGE IGNITER.
IF CHECKS ARE OK.....REPLACE CONTROL.
SYSTEM RUNS UNTIL CALL FOR HEAT ENDS
NO
YES
NOTE: IF IGNITION CONTROLS GOES INTO A LOCKOUT, INTERRUPT POWER AND RESTART.
CHECK CONTINUITY OF SENSOR CABLE AND GROUND WIRE AS A POOR GROUND COULD RESULT IN ERRATIC BEHAVIOUR AND NUISANCE SHUTDOWNS EVEN THOUGH OPERATION IS NORMAL AT THE TIME OF CHECKOUT.
CHECK FOR EXCESSIVE HEAT AT SENSOR INSULATOR AS TEMPERATURES ABOVE 1000°F(538°C) CAUSES SHORT TO GROUND.
CHECK FLAME SIGNAL IN SERIES WITH THE GROUND AND MODULE FOR A MINIMUM 1.5UA.
IF SIGNAL IS LOWER CHANGE IGNITER.
IF CHECKS ARE OK.....REPLACE CONTROL.
CALL FOR HEAT ENDS:
SYSTEM SHUTS OFF
NO
YES
CHECK TEMPERATURE CONTROLLER.
CHECK FOR FAULTY WIRING, REMOVE GAS VALVE LEAD AT CONTROL ,
IF VALVE CLOSES, RECHECK THE TEMPERATURE CONTROLLER AND WIRING.
IF VALVE STAYS OPEN....REPLACE GAS VALVE
TROUBLESHOOTING ENDS
SEE S87J DSI CHECK

23. START-UP / COMMISSIONING SHEET

THIS EQUIPMENT HAS BEEN FACTORY FIRED AND TESTED PRIOR TO SHIPMENT. HOWEVER, THIS APPLIANCE IS NOT "PLUG & PLAY". IT REQUIRES COMMISSIONING AND FIELD ADJUSTMENT / SPECIFICATIONS CONFIRMATION TO ENSURE SAFE AND EFFICIENT OPERATION.

COMMISSIONING REPORT
AS PER I&O MANUAL AND LOCAL CODES

CONTRACTOR NAME: .....DATE.....

ADDRESS:.....

.....

CITY:.....

PHONE:.....

CELL: .....

JOB SITE.....CITY.....

HEATER MODEL NUMBER:.....
Located on burner rating plate

HEATER SERIAL NUMBER: .....
Located on burner rating plate

TO ENSURE THAT SITE CONDITIONS ARE COMPATIBLE WITH THE HEATER'S PERFORMANCE AND TO ALLEVIATE NUISANCE CALL-BACKS, THE FOLLOWING START-UP NEEDS TO BE COMPLETED BY THE QUALIFIED GAS INSTALLER.

A TECHNICIAN CALLING FOR TECHNICAL SUPPORT MUST PROVIDE THE INFORMATION FROM THE COMPLETED COMMISSIONING REPORT ON THE NEXT PAGE

FAX COMPLETED REPORT TO TECHNICAL SERVICES:
FAX 1-866-361-0523,
VOICE 1-877-446-3727

WARNING

START UP 'SMOKE'

During start up, material coatings used in the production process of tubes and reflectors will "burn off" and create smoke during the first hour of operation. This is temporary and normal.

Please ensure that there is sufficient ventilation to adequately clear the smoke from the space.

Notify site and safety personnel to ensure that alarm systems are not unduly activated.

QUALIFIED INSTALLER TO COMPLETE THIS TUBE HEATER COMMISSIONING REPORT

TYPE OF GAS:	NG ☐	LP ☐
DOES BUILDING HAVE A NEGATIVE CONDITION:	YES ☐	NO ☐
IF THIS IS A HIGH ALTITUDE AREA WHAT IS THE ALTITUDE ABOVE SEA LEVEL	_____ Ft	
DOES APPLICATION REQUIRE FRESH AIR TO BURNER	YES ☐	NO ☐
IS HEATER EXPOSED TO CHEMICAL OR CORROSIVE ATMOSPHERE:	YES ☐	NO ☐
ARE ACTUAL MINIMUM CLEARANCES AS PER TABLE 3	YES ☐	NO ☐
CAN HEATER BE AFFECTED BY OVERHEAD CRANES / VIBRATION	YES ☐	NO ☐
ARE GAS SUPPLY LINES ADEQUATELY SIZED FOR SYSTEM	YES ☐	NO ☐
GAS LINES AND BRANCHES HAVE BEEN PURGED OF AIR:	YES ☐	NO ☐
THIS HEATER FIRED WITHOUT ANY MALFUNCTION:	YES ☐	NO ☐
INLET GAS SUPPLY PRESSURE WITH HEATER OPERATING :	_____	WC"
GAS VALVE OUTLET (Manifold) PRESSURE WITH HEATER OPERATING:	_____	WC"
WHAT IS THE LINE VOLTAGE READING AT THE HEATER	_____	VOLTS
WHAT IS THE VOLTAGE READING AT THE IGNITION MODULE	_____	VOLTS
WHAT IS THE FLAME SIGNAL STRENGTH IN uA FROM SENSOR:	_____	uA (microamps)
IS HEATER CONTROLLED BY A THERMOSTAT	YES ☐	NO ☐
IS THE THERMOSTAT STRATEGICALY LOCATED	YES ☐	NO ☐
WHAT IS TOTAL LENGTH OF INSTALLED THERMOSTAT WIRE	_____	FEET
WHAT IS THE GAUGE OF THE THERMOSTAT WIRE	_____	GAUGE
WHAT IS THE HEATER TUBE LENGTH (10ft per Tube section)	_____	FEET
WHAT IS THE TOTAL LENGTH OF THE VENT (add 10ft for each bend)	_____	FEET
WHAT LENGTH IS COMBUSTION AIR INTAKE (add 10ft for each bend)	_____	FEET
IF REQUIRED....WHAT IS THE LENGTH OF THE TURBULATOR(S)	_____	FEET
IF INSTALLED....IS TURBULATOR AT FLUE END OF SYSTEM	YES ☐	NO ☐
"MAXIMUM STACKING HEIGHT" SIGN(S) - POSTED AT THERMOSTAT(S)	☐	

THIS HEATER MUST BE ELECTRICALLY GOUNDED

FAX COMPLETED REPORT TO TECHNICAL SERVICES: FAX 1-866-361-0523, VOICE 1-877-446-3727

24. BTUH INPUT RATINGS AND CORRESPONDING DIMENSIONS

HIGH-FIRE INPUT BTUH	NOMINAL LENGTH (FT)	OVERALL HEATER LENGTH* (FT)	APPROX NET WEIGHT** (LBS)
200,000	60	60'	282
200,000	50	50’ 4”	239
175,000	60	60'	282
175,000	50	50’ 4”	239
155,000	50	50’ 4”	239
155,000	40	40’ 8”	197
130,000	40	40’ 8”	197
130,000	30	31'	154

HIGH-FIRE INPUT BTUH	NOMINAL LENGTH (FT)	OVERALL HEATER LENGTH* (FT)	APPROX NET WEIGHT** (LBS)
110,000	40	40’ 8”	197
110,000	30	31'	154
100,000	20	21’ 4”	111
80,000	30	31'	154
80,000	20	21’ 4”	111

→ Manufactured and shipped in 10 ft lengths.

→ Swaged tube has approximate 4 inch (10 cm) overlap -

- Net length of first and intermediate tubes is 116 inches (295 cm)
- Last tube is 120” (305 cm) [the 4 inch swage length is exposed for vent connection]
- Total tube length is approximately 4 inches (10 cm) shorter for each multiple of 10 feet (305 cm)
- Overall length of heater includes the burner.

** Burner weight is 26 pounds (11.8 kg)
Each 10 ft (305 cm) tube/reflector section weighs 82 pounds (37.2 kg)

FIGURE 21 BURNER DIMENSIONS

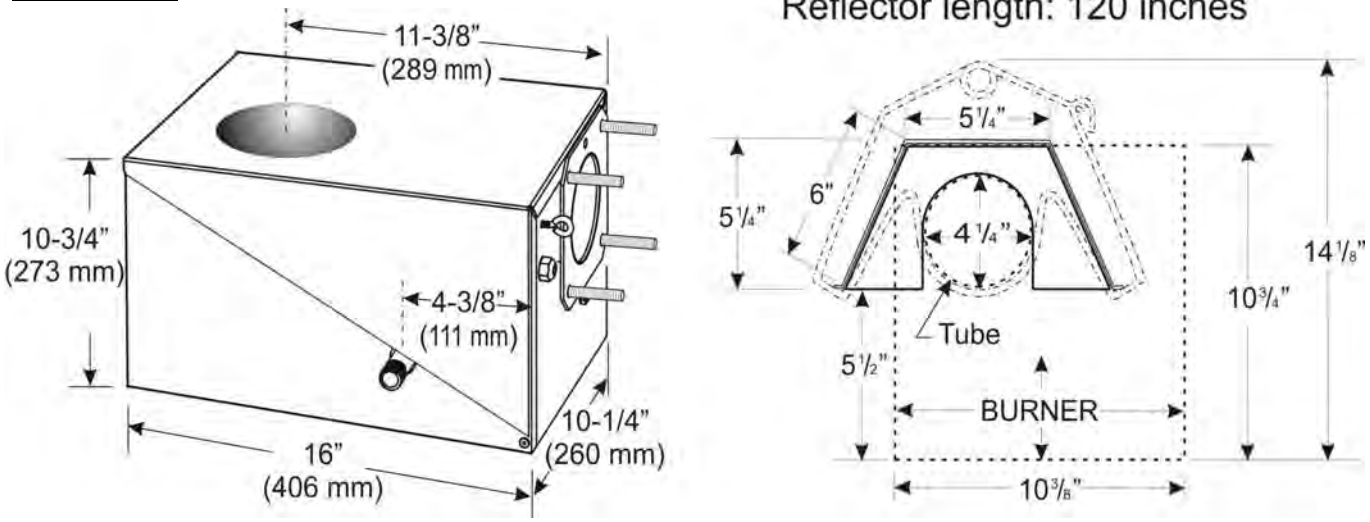
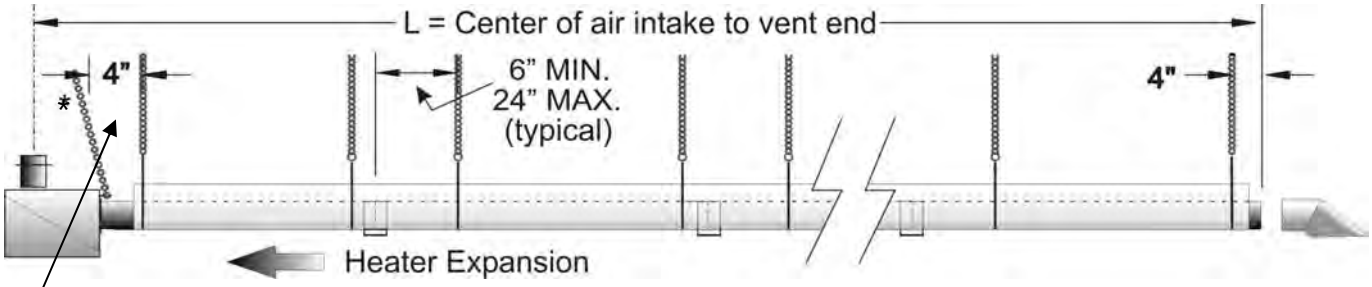


FIGURE 22 HANGER SPACING / LENGTH - AIR INTAKE TO VENT END



- POSITION BURNER END HANGER 4 INCHES (10 CM) FROM BURNER
- LOCATE SYSTEM HANGERS NO LESS THAN 6 INCHES (15 CM) AND NO MORE THAN 24 INCHES (61 CM) FROM TUBE COUPLING

* ANGLE BURNER SUPPORT CHAIN BACK OVER BURNER - ALLOWS TUBE SYSTEM EXPANSION

Tube Length	'**L**' = center air intake to vent end	Tube Length	'**L**' = center air intake to vent end
20'	20'-11 3/4" ; 251 3/4" ; 628 cm	50'	49'-11 3/4" ; 599 3/4" ; 1523 cm
30'	30'-7 3/4" ; 367 3/4" ; 934 cm	60'	59'-7 3/4" ; 715 3/4" ; 1818 cm
40'	40'-3 3/4" ; 483 3/4" ; 1229 cm		

25A. BURNER & TUBE KIT ASSEMBLY CHART MODELS SET / ITT

MODELS SET & ITT are approved for indoor commercial / industrial non-residential applications. For outdoor, wet and harsh environment applications refer to models SPW-JZ / IWP (powder coated burner box) and/or STW-JZ / IW (stainless steel burner box).

BEFORE INSTALLING: ENSURE you have the CORRECT TUBE KIT(s) for the BURNER INPUT

		'SET / ITT' TUBE KIT PART # & QUANTITY REQUIRED						
Tube Kit Shipping Weight (lbs) →		**Stand-Alone Kits**			**Primary Kits**		**Secondary Kits**	
		120	170	210	165	165	120	165
Nominal Length (ft) →		**20'**	**30'**	**40'**	**30'**	**30'**	**20'**	**30'**
MODEL		**TM-1420-SX**	**TM-1430-SX**	**TM-1040-SX**	**TM-F030-SX**	**TM-1030-SX**	**TM-0020-SX**	**TM-0030-SX**
80/60	20'	**1**						
	30'		**1**					
110/75	30'		**1**					
	40'			**1**				
130/90	30'		**1**					
	40'			**1**				
155/110	40'			**1**				
	50'				**1+**		**1**	**1**
175/125	50'					**1+**	**1**	
	60'					**1+**		**1**
200/140	50'					**1+**	**1**	
	60'					**1+**		**1**

TUBE KITS (Not emissive coated)

Stand-Alone tube kits require no additional tube kits.

Primary tube kits require at least one additional Secondary tube kit.

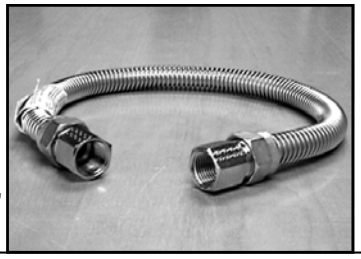
Secondary tube kit require a Primary tube kit.

FLEXIBLE GAS CONNECTOR (Included in Burner Kit) - MUST INSTALL - see Section 13

USA - Stainless Steel Flexible Gas Connector

130,000 or less:
JL-0771-XX - 1/2”x24”

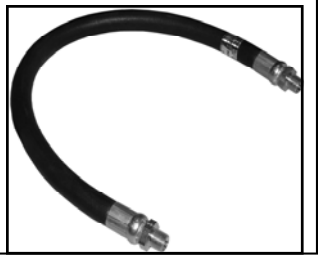
155,000 or more:
JL-0771-YY - 3/4”x36”



CANADA - Type 1 Hose Gas Connector

130,000 or less:
JL-0771-RC - 1/2”x36”

155,000 or more:
JL-0771-RB - 3/4”x36”



25B. BURNER & TUBE KIT ASSEMBLY CHART MODELS S100U / ITBU

MODELS S100U & ITBU are approved for indoor commercial / industrial non-residential applications. For outdoor, wet and harsh environment applications refer to models SPW-JZ / IWP (powder coated burner box) and/or STW-JZ / IW (stainless steel burner box).

BEFORE INSTALLING: ENSURE you have the CORRECT TUBE KIT(s) for the BURNER INPUT

		SETU / ITTU TUBE KIT PART # & QUANTITY REQUIRED					
Tube Kit Shipping Weight (lbs) →		Stand-Alone **			Primary **		2ndary
		100	145	170	170	170	65
Tube Length (ft) →		**10'** x 2	**15'** x 2	**20'** x 2	**20'** x 2	**20'** x 2	**10'** x 2
MODEL		**TM-1410-SU**	**TM-1415-SU**	**TM-1020-SU**	**TM-0020-SU**	**TM-A120-SU**	**TM-0010-SU**
80/60	2 x 10'	**1**					
	2 x 15'		**1**				
110/75	2 x 15'		**1**				
	2 x 20'			**1**			
130/90	2 x 15'		**1**				
	2 x 20'			**1**			
155/110	2 x 20'			**1**			
	2 x 30'				**1+**		**1**
175/125	2 x 30'					**1+**	**1**
200/140	2 x 30'					**1+**	**1**

*** These kits include Turn Box JS-0513-BU packed and shipped in a separate carton*

TUBE KITS (Not emissive coated)

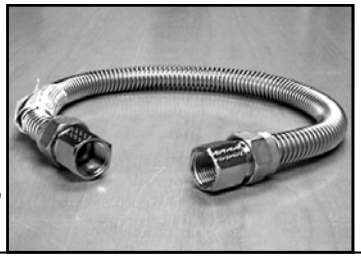
Stand-Alone tube kits require no additional tube kits.
Primary tube kits require at least one additional Secondary tube kit.
Secondary tube kit require a Primary tube kit.

FLEXIBLE GAS CONNECTOR (Included in Burner Kit) - MUST INSTALL - see Section 13

USA - Stainless Steel Flexible Gas Connector

130,000 or less:
JL-0771-XX - 1/2”x24”

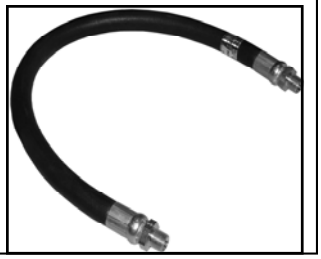
155,000 or more:
JL-0771-YY - 3/4”x36”



CANADA - Type 1 Hose Gas Connector

130,000 or less:
JL-0771-RC - 1/2”x36”

155,000 or more:
JL-0771-RB - 3/4”x36”



26. TURBULATORS:

NOTE: Improper location of a turbulator can cause malfunction of the heater, property damage, and will void the heater warranty.

Tube Heaters are supplied with all required turbulator(s) factory installed into the tube(s). Tubes with turbulators are installed at the vent end of the system configuration and are clearly labeled for easy identification.

MODEL	TURBULATOR LENGTH	MODEL	TURBULATOR LENGTH
SET / ITT 200/140 - 60	**6' (2 m) ****	SET / ITT 110/75 - 40	10' (3 m)
SET / ITT 200/140 - 50	10' (3 m)	SET / ITT 110/75 - 30	14' (4.3 m)
SET / ITT 175/125 - 60/50	10' (3 m)	SET / ITT 100/70 - 20	10' (3 m) S/S
SET / ITT 155/110 - 50	not required	SET / ITT 80/60 - 30	14' (4.3 m)
SET / ITT 155/110 - 40	10' (3 m)	SET / ITT 80/60 - 20	14' (4.3 m)
SET / ITT 130/90 - 40	10' (3 m)		
SET / ITT 130/90 - 30	14' (4.3 m)		

** **200 x 60 ft**: Remove 4 ft piece of turbulator from upstream end of last tube prior to installation

MODEL	TURBULATOR LENGTH	MODEL	TURBULATOR LENGTH
SETU / ITTU 200/140 - 30U	6' (2 m)	SETU / ITTU 130/90 - 15U	14' (4.3 m)
SETU / ITTU 175/125 - 30U	10' (3 m)	SETU / ITTU 110/75 - 20U	10' (3 m)
SETU / ITTU 155/110 - 30U	not required	SETU / ITTU 110/75 - 15U	14' (4.3 m)
SETU / ITTU 155/110 - 20U	10' (3 m)	SETU / ITTU 80/60 - 15U	14' (4.3 m)
SETU / ITTU 130/90 - 20U	10' (3 m)	SETU / ITTU 80/60 - 10U	14' (4.3 m)

27. HIGH ALTITUDE INSTALLATION

When this appliance is installed above the altitude stipulated below, the input must be de-rated by 4% for each 1000 ft . **If your local utility supplies gas with a de-rated heat content, no orifice change is required in the heater** . Check with your local utility regarding de-rating.

USA: The factory installed orifice for this appliance is approved for altitudes zero to 2000 feet above sea level. Above 2000 feet, refer to table below.

Canada: The factory installed orifice for this appliance is approved for altitudes zero to 4500 feet above sea level. When installed above 4500 feet, refer to the table below.

~ ORIFICE TABLE NEXT PAGE ~

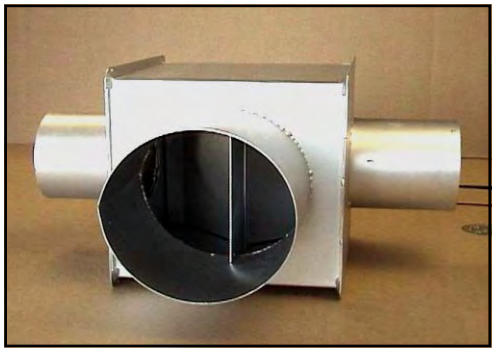
27. HIGH ALTITUDE INSTALLATION *continued*

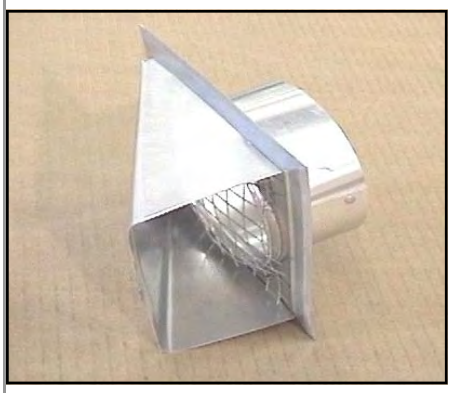
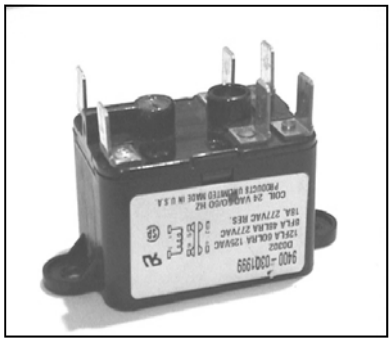
ORIFICE CHART - ALTITUDE CONVERSION

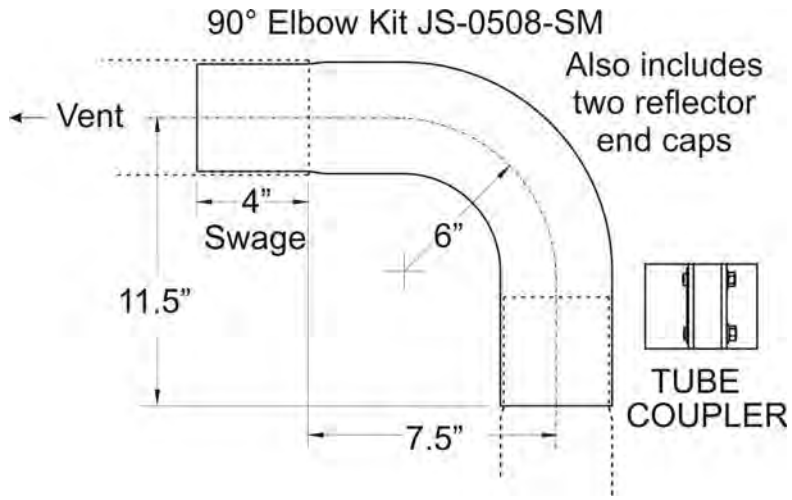
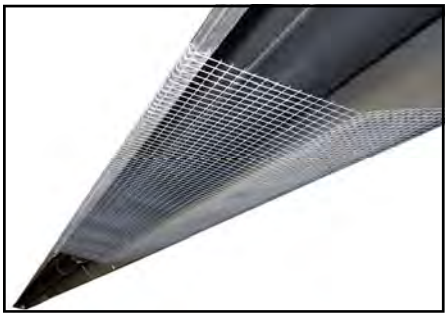
~ SEE NOTES ON PREVIOUS PAGE ~

MODEL	FOR USE AT ALTITUDES ABOVE (FEET) Gas Orifice Drill Size / Part#							
	Supplied	USA Only			USA & CANADA*			
	0	2000	3000	4000	5000	6000	7000	8000
SET / ITT- 80/60 NG	18 DMS JS-0718-DM	19 DMS JS-0719-DM	19 DMS JS-0719-DM	20 DMS JS-0720-DM	21 DMS JS-0721-DM	22 DMS JS-0722-DM	23 DMS JS-0723-DM	24 DMS JS-0724-DM
SET / ITT- 80/60 LPG	36 DMS JS-0736-DM	38 DMS JS-0738-DM	39 DMS JS-0739-DM	39 DMS JS-0739-DM	40 DMS JS-0740-DM	41 DMS JS-0741-DM	42 DMS JS-0742-DM	42 DMS JS-0742-DM
SET / ITT-100/70 NG	11 DMS JS-0711-DM	13 DMSJS-0713-DM	13 DMS JS-0713-DM	14 DMS JS-0714-DM	15 DMS JS-0715-DM	16 DMS JS-0716-DM	17 DMS JS-0717-DM	18 DMS JS-0718-DM
SET / ITT-100/70 LPG	32 DMS JS-0732-DM	33 DMS JS-0733-DM	34 DMS JS-0734-DM	35 DMS JS-0735-DM	35 DMS JS-0735-DM	36 DMS JS-0736-DM	36 DMS JS-0736-DM	37 DMS JS-0737-DM
SET / ITT-110/75 NG	5.2 mm JS-0752-MM	5.1 mm JS-0751-MM	5.0 mm JS-0750-MM	9 DMS JS-0709-DM	11 DMS JS-0711-DM	0.19 i N JS-0719-IN	13 DMS JS-0713-DM	14 DMS JS-0714-DM
SET / ITT-110/75 LPG	31 DMS JS-0731-DM	32 DMS JS-0732-DM	32 DMS JS-0732-DM	32 DMS JS-0732-DM	33 DMS JS-0733-DM	34 DMS JS-0734-DM	35 DMS JS-0735-DM	36 DMS JS-0736-DM
SET / ITT-130/90 NG	5.8 mm JS-0758-MM	5.7 mm JS-0757-MM	5.6 mm JS-0756-MM	5.5 mm JS-0755-MM	3 DMS JS-0703-DM	4 DMS JS-0704-DM	5 DMS JS-0705-DM	0.20 in JS-0720-IN
SET / ITT-130/90 LPG	29 DMS JS-0729-DM	29 DMS JS-0729-DM	30 DMS JS-0730-DM	30 DMS JS-0730-DM	30 DMS JS-0730-DM	30 DMS JS-0730-DM	31 DMS JS-0731-DM	31 DMS JS-0731-DM
SET / ITT-155/110 NG	0.25 in JS-0725-IN	6.4 mm JS-0764-MM	6.3 mm JS-0763-MM	6.2 mm JS-0762-MM	6.1 mm JS-0761-MM	6.0 mm JS-0760-MM	5.9 mm JS-0759-MM	5.8 mm JS-0758-MM
SET / ITT-155/110 LPG	0.14 in JS-0714-IN	3.5 mm JS-0735-MM	29 DMS JS-0729-DM	3.4 mm JS-0734-MM	3.3 MM JS-0733-MM	3.3 MM JS-0733-MM	30 dms JS-0730-DM	0.13 in JS-0713-IN
SET / ITT-175/125 NG	6.7 mm JS-0767-MM	6.6 mm JS-0766-MM	6.6 mm JS-0766-MM	6.5 mm JS-0765-MM	6.5 mm JS-0765-MM	6.4 mm JS-0764-MM	6.3 mm JS-0763-MM	6.3 mm JS-0763-MM
SET / ITT-175/125 LPG	21 DMS JS-0721-DM	23 DMS JS-0723-DM	23 DMS JS-0723-DM	24 DMS JS-0724-DM	25 DMS JS-0725-DM	26 DMS JS-0726-DM	27 DMS JS-0727-DM	28 DMS JS-0728-DM
SET / ITT-200/140 NG	0.30 in JS-0730-IN	7.4 mm JS-0774-MM	7.3 mm JS-0773-MM	7.3 mm JS-0773-MM	7.2 mm JS-0772-MM	0.28 in JS-0728-IN	7.1 mm JS-0771-MM	7.0 mm JS-0770-MM
SET / ITT-200/140 LPG	19 DMS JS-0719-DM	20 DMS JS-0720-DM	20 DMS JS-0720-DM	21 DMS JS-0721-DM	22 DMS JS-0722-DM	23 DMS JS-0723-DM	25 DMS JS-0725-DM	26 DMS JS-0726-DM

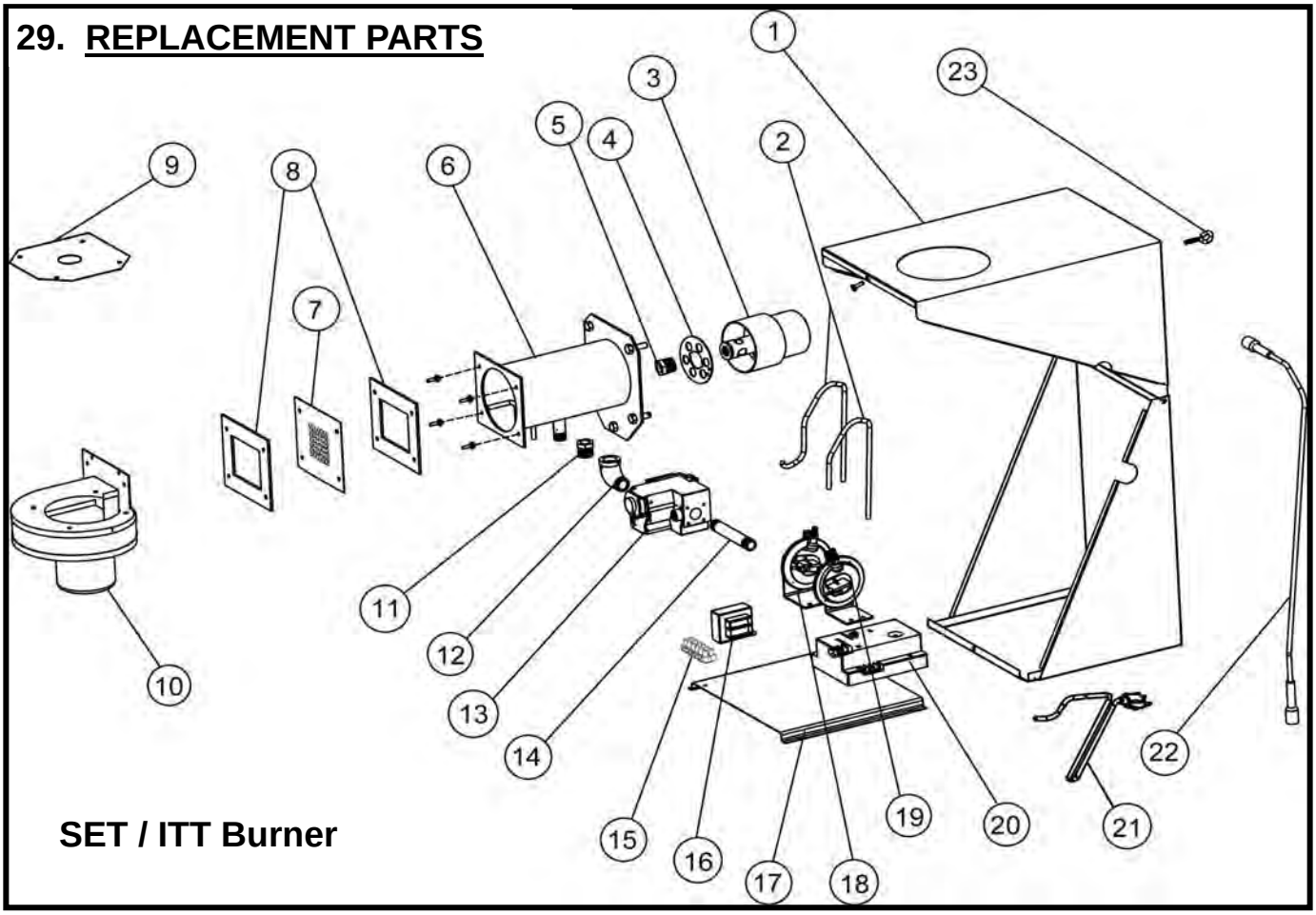
28. OPTIONAL ACCESSORIES

#2 Lion Chain (115 lb work load) **- 200 ft roll** **'S' Hooks** - 1 7/8" - package of 25	JL-0800-XX JL-0798-SH	
Flue Vent Terminal 4" wall horizontal 6" wall horizontal	 JA-0528-XX JA-0529-XX	
Torctite Coupler Sufficient quantity supplied with heater Use for connection of vent tee, or replacement part	JA-0516-SW	
Vent Tee 4" X 4" X 6" (Couplers optional - see above)	JA- 0514-XX	

Fresh Air Intake Adapter	JS-0532-SE	
Fresh Air Intake Cap—Wall	JS-0532-VC	
Fresh Air Intake Cap—Roof 4” roof cap 6” roof cap	 JA-0530-XX JA-0531-XX	
2-Stage Low Voltage Digital Thermostat (24 Volts - °F or °C selectable) *Not for use in corrosive or wet environments*	JS-0569-DT	
<u>Required For MULTIPLE HEATERS per Thermostat</u>:		
24 RELAY <u>Multiple Tube Heaters</u> controlled by a single 2-Stage Thermostat (field installed)	JS-0568-XX	

90 degree Aluminized Steel Elbow Kit (Kit includes: aluminized steel elbow, coupler, and two reflector end caps) For 180° elbow use two x JS-0508-SM, or use Model SETU / ITTU that includes 180° Turn Box	JS-0508-SM	
		
Side Reflector Extension Kit- l0" deep, l0 ft long Each Includes 3 'S' Hooks	JS-0509-KT	
Tube Protection Screen -5 foot lengths	JA-0780-XX	

29. REPLACEMENT PARTS

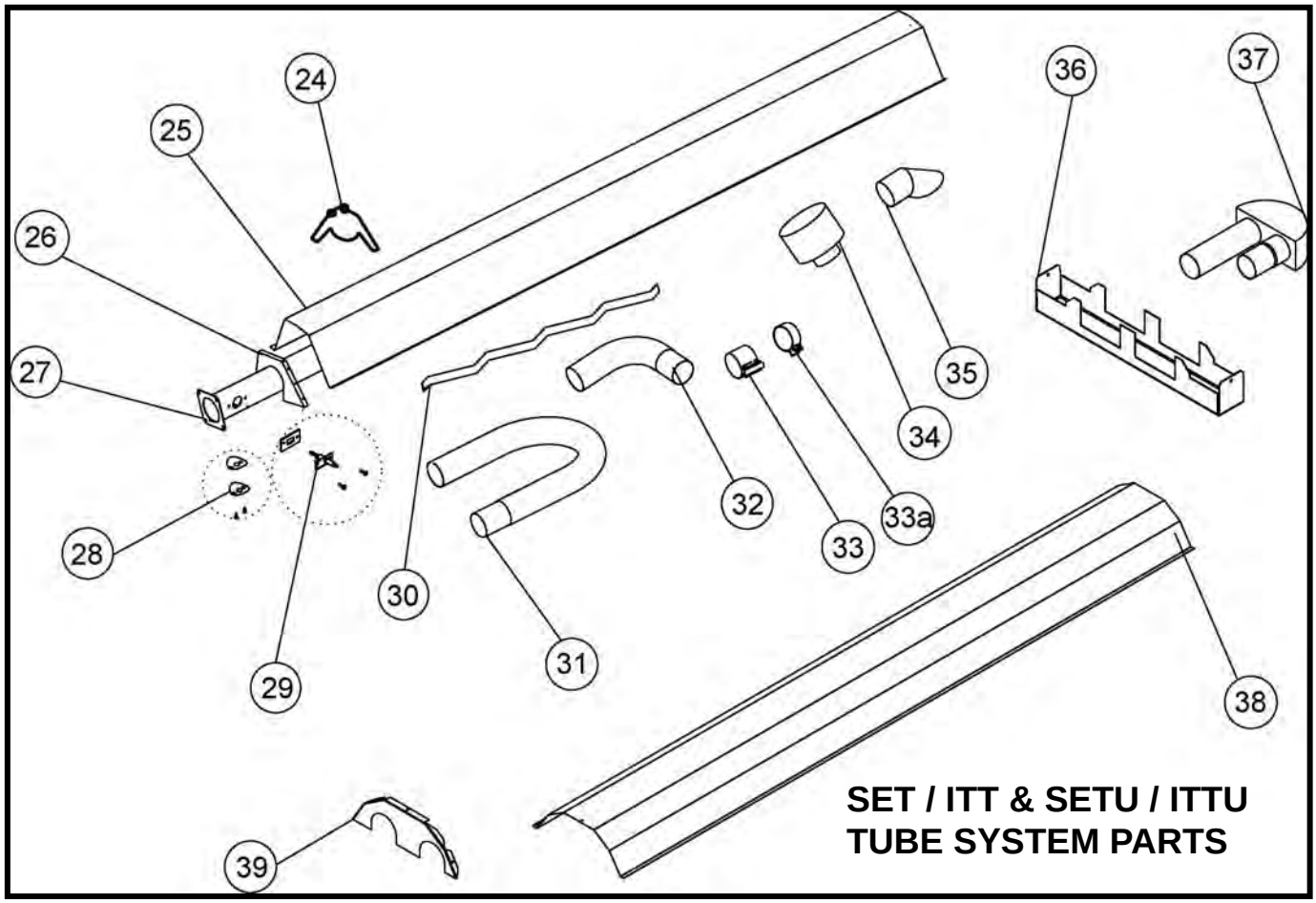


SET / ITT Burner

#	PART DESCRIPTION	PART #	PART DESCRIPTION PRIMARY	SUPPLEMENT
1	**BURNER HOUSING**	JS-0582-XX	Burner housing (painted orange)	
2	**PRESSURE SWITCH TUBING**	JS-0572-SE	P.V.C. tubing set (2 x 20")	
3	**BURNER HEAD**	JS-0510-LP	Burner head (45-80)	60-80
		JS-0512-XX	Burner head (110-200)	110-200
4	**AIR RESTRICTOR RING**	JS-0596-XX	Burner head air rest. ring .375	60LP,60-200NG
		JS-0597-XX	Burner head air rest. ring .500	80-200LP
5	**MAIN BURNER ORIFICE**	JS-0736-DM	Gas orifice low intensity HTR 36 DMS	80 LP
		JS-0718-DM	Gas orifice low intensity HTR 18 DMS	80 NG
		JS-0731-DM	Gas orifice low intensity HTR 31 DMS	110 LP
		JS-0752-MM	Gas orifice low intensity HTR 5.2 mm	110 NG
		JS-0729-DM	Gas orifice low intensity HTR 29 DMS	130 LP
		JS-0758-MM	Gas orifice low intensity HTR 5.8 mm	130 NG
		JS-0714-IN	Gas orifice low intensity HTR 9/64 inch	155 LP
		JS-0725-IN	Gas orifice low intensity HTR 1/4 inch	155 NG
		JS-0767-MM	Gas orifice low intensity HTR 6.7 mm	175 NG
		JS-0730-IN	Gas orifice low intensity HTR 19/64 inch	200 NG
6	**OUTER BURNER**	JS-0504-XX	Outer burner assembly - Silver	NG
		JS-0504-BK	Outer burner assembly - Black	LP
7	**EQUALIZER PLATE**	JS-0593-XX	Outlet equalizer plate (60 to 200)	
8	**BLOWER GASKET**	JS-0578-XX	Outlet blower gasket	each

#	PART DESCRIPTION	PART #	PART DESCRIPTION PRIMARY	SUPPLEMENT
9	**AIR INLET C/W SCREEN**	JS-0595-AC	blower ring c/w 1 1/2" bird screen	80/60, 110/80
		JS-0595-EP	blower ring c/w 1 3/4" bird screen	155/110 NG/LP, 130/90 NG
		JS-0595-AE	blower ring c/w 2" bird screen	175/200 NG
		JS-0595-AB	blower ring c/w 2 1/8" bird screen	130/90 LP
		JS-0595-EA	blower ring c/w 3 1/8" bird screen	200/140 NG
10	**BLOWER**	JS-0579-AA	Blower assembly tube burner	
11	**MANIFOLD BUSHING**	JS-0589-XX	Manifold bushing	
12	**90 DEGREE ELBOW FITTING 1/2"**	JS-0588-XX	90 degree street elbow fitting	1/2"
13	**GAS VALVE**	JA-0507-TT	Two Stage Gas Valve LP VR8205Q2944	LP
		JA-0506-TT	Two Stage Gas Valve NG VR8205Q2480	NG
14	**4" NIPPLE**	JS-0590-XX	4" nipple	
15	**TRANSFORMER**	JA-0775-XX	Transformer 120/24V, 20VA AT120B1028	
16	**TERMINAL BLOCK**	JM-0455-DD	Terminal Block -6	
	THERMOSTAT RELAY KIT (not shown)	JS-0568-KT	Thermostat Relay Kit 24V	
17	**COMPONENT PLATE**	JS-0581-SE	component mounting plate	
18	**COMBUSTION AIR PROVING SWITCH**	JS-0575-YY	Air proving switch .65" W.C.	80/60, 110/80
		JS-0575-ZC	Air proving switch .80" W.C.	155/110
		JS-0575-ZB	Air proving switch .90" W.C.	130/90, 175/120
		JS-0575-ZA	Air proving switch 1.40" W.C.	200/140
19	**BLOCKED FLUE PROVING SWITCH**	JS-0577-TT	Blocked flue switch .60" W.C.	80/60, 175/120
		JS-0577-RR	Blocked flue switch .46" W.C.	110/80
		JS-0577-TS	Blocked flue switch .80" W.C.	130/90, 155/110
		JS-0577-YA	Blocked flue switch .70" W.C.	200/140
22	**ELECTRICAL CORD**	JB-0567-XX	Cord - electrical 6'	
23	**EYE BOLT**	JF-1012-EB	Eye bolt	

Burners with FENWAL IGNITION CONTROL - Models: SET-F; ITT-F				
20	**FENWAL DSI CONTROL**	JA-0567-XX	3-Trial 24Vac with blower relay	"-F" Models
	REPLACEMENT KIT: FENWAL CONTROL	JA-0568-KT	Fenwal Control + Wire Harness + Cable + Igniter: Replaces Fenwal & S87J	
21	**IGNITION CABLE**	JS-0518-SA	Hi voltage wire (24") STW - 2 x 1/4" Spades	
Burners with HONEYWELL S87-J IGNITION CONTROL - Models: SET / ITT				
20	~~**HONEYWELL IGNITION CONTROL**~~	~~JA-0568-XX~~	DISCONTINUED - NO LONGER AVAILABLE	
	REPLACEMENT KIT: WITH FENWAL DSI	JA-0568-KT	Fenwal Control + Wire Harness + Cable + Igniter: REPLACES S87J	
21	**IGNITION CABLE HONEYWELL S87J**	JS-0518-XX	Wire hi voltage (24") S87J Bullet Connection	
Burners with CHANNEL GASLITER MICRO 50N IGNITION CONTROL - Models: SET-C; ITT-C				
20	CHANNEL MICRO 50N IGNITION CONTROL	JB-0568-AA	3 Try Potted MICRO 50N DSI - Replaces existing MICRO 50N Control	
	Wiring Harness *(not shown)*	JB-0568-WH-	Wiring Harness for connection of MICRO 50N	
21	**IGNITION CABLE**	JS-0518-SA	Hi voltage wire (24") STW - 2 x 1/4" Spades	

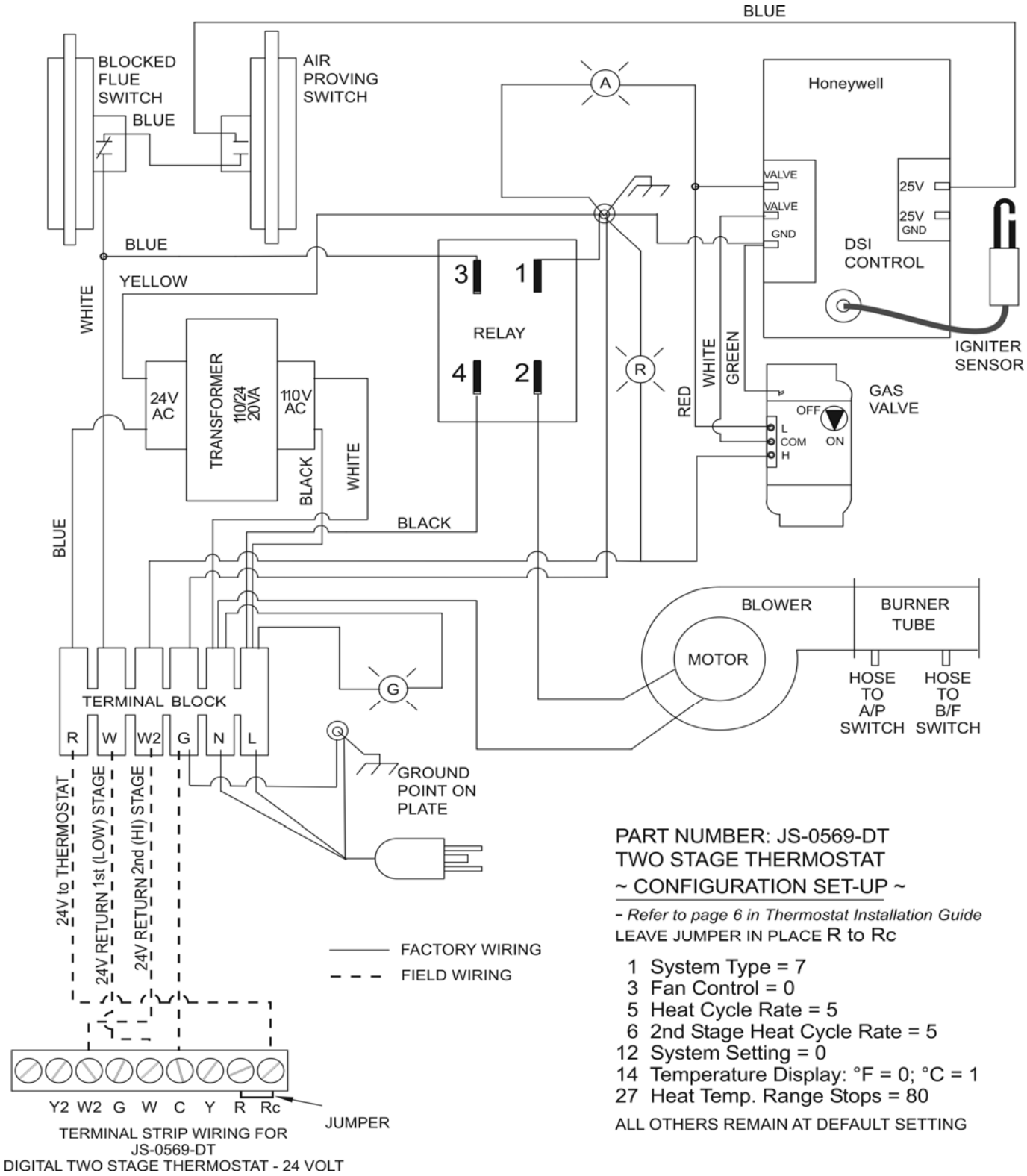


#	PART DESCRIPTION	PART #	PART DESCRIPTION PRIMARY	SUPPLEMENT
24	**WIRE HANGER**	JS-0505-EH	Small wire hanger	
25	**REFLECTOR**	JS-0502-EM	Reflector (18" x 120")	
26	**END CAP**	JS-0502-ES	S100 / ITB series reflector end cap	
27	**LOW INTENSITY TUBE**	JS-0501-SW-P	Aluminized tube,flanged,swaged c/w ports	60-155
		JS-0501-SK	Aluminized tube, 10' slotted + Accuseal clamp	175-200
		JS-0499-SW-P	Alumatherm tube,flanged,swaged c/w ports	175-200
		JS-0515-SW-P	Steel tube 10' swaged	
		JS-0515-SW-5	Steel tube 5' swaged	
28	**SIGHT GLASS ASSEMBLY**	JS-0536-XX	Sight glass assembly tube heater	
29	**IGNITER KIT**	JA-0571-KT	Igniter & gasket kit / DSI tube heater	
30	**TURBULATOR** (see Table 4 in Manual)	JS-0534-SS	Turbulator 5' (7 PLATE)	45 x 10 ft ONLY
		JS-0533-SH	Short turbulator 4'	
		JS-0533-LG	Turbulator 10'	
31	**ELBOW 4"**	JA-0508-SW	90 degree elbow	
32	**ELBOW 4"**	JA-0513-SW	180 degree elbow	
33	**COUPLER**	JA-0516-SW	4" swaged tube coupler torctite	
33a	**COUPLER 175 & 200 Mbh**	JA-0516-RK	Coupler 4" with Rivet & Drill Bit	175-200
34	**VENT CAP**	JA-0530-XX	4" roof vent cap	
35	**VENT CAP**	JA-0528-XX	4" horizontal wall vent terminal	
36	**DOUBLE STEEL HANGER**	JS-0505-BU	U tube reflector hanger	
37	**TURN BOX**	JS-0513-BU	U tube turn around box	
38	**DOUBLE REFLECTOR**	JS-0502-BU	Wide reflector 24" x 120"	
		JS-0502-BU5	Wide reflector 24" x 60"	
39	**U REFLECTOR END CAP**	JS-0502-ND	S100 / ITB series "U" reflector end cap	
	COMPLETE TUBE KITS	Refer to Current Price List		

HONEYWELL S87J WIRING DIAGRAM - 24 VAC 2-STAGE THERMOSTAT

(*FENWAL DSI - PAGE 31; MULTIPLE HEATERS PER THERMOSTAT - PAGE 32*)

(CHANNEL MICRO 50N DSI - PAGES 56-58)



The heater must be electrically grounded in accordance with the National Electrical Code. ANSI / NFPA 70 or current Canadian Electrical code CSA C22.1.

HONEYWELL S87J SEQUENCE OF OPERATION

The S87 ignition control module is powered by a 24v transformer and activated when the thermostat calls for heat. On every call for heat the S87J will delay start-up to provide a 30 second system pre-purge. When the S87 is activated by a thermostat or call for heat an internal transformer provides power to the electronic generator circuit for Spark Ignition and the safety lockout timing begins. At the same time, the S87 opens the gas controls main valve allowing gas to flow to the main Burner.

The S87 Control Module performs the following basic functions:

- Provides a 30 second system pre-purge
- Supplies power to the electronic pulse-generator circuit for the Spark Igniter (30,000 volts open circuit).
- Allows 21 seconds for Ignition trial (TFI) before system safety lockout occurs.
- Senses the Burner flame for safe lighting
- Shuts off the spark after the Burner is lit.

Burner with direct spark ignition, sequence is as follows :

1. **Two Stage 24 Volt Thermostat:**

   The 120 volt supply to heater will power the 120v/24v Transformer and the 120V side of the Blower switching relay simultaneously. A call for heat by the 24 volt Thermostat energizes the 24 volt control circuit and the 24v/120 volt relay powering the Blower.

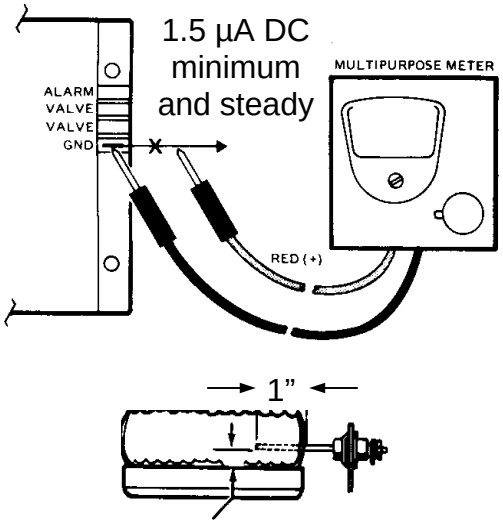
2. The 24 volt control circuit powers the DSI control in series through the normally open Air Pressure Switch (APS) and the normally closed Blocked Flue Switch (BFS).
3. The Blower creates a positive pressure and closes a normally open contact inside the Air Proving Switch (APS).
4. 24 volts supplied to the DSI control initiates the 30 second pre-purge cycle.
5. After completing the 30 second pre-purge cycle the DSI control generates high voltage to the Spark Igniter, and 24 volts to energize the Gas Valve.
6. The Burner will light and establish a steady flame.
7. Once the flame sensor determines there is a steady flame established, with a minimum flame signal of 1.5 µA the spark igniter is then de-energized.
8. In the event ignition does not occur, the safety circuit will function to interrupt gas flow after approximately 21 seconds and lock the system out. No further gas will flow until the power has been manually interrupted for a period of 30 seconds. This will reset the ignition module and the operating sequence will restart at step #1
9. If the blower does not run, the blower air pressure switch (normally open contact) does not close and power is not supplied to the ignition control.
10. The two stage thermostat first provides a low-fire signal to the gas valve which then provides 2.2” w.c. NG (4.8” w.c. LPG) to the manifold.
11. If the thermostat is not satisfied in a predetermined time period, then the thermostat calls for high-fire by activating a second solenoid in the gas valve which provides 3.5” w.c NG (10” w.c. LPG) to the manifold.

HONEYWELL S87J FLAME SENSING CIRCUIT

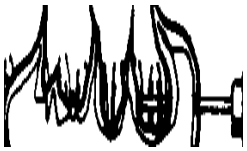
The output of the flame sensing circuit cannot be checked directly on the S87 body. Check the flame sensing circuit directly by checking the flame sensing current from the sensor to the S87 as follows.

1. Connect a meter (dc microammeter scale) in series with the flame signal ground wire as shown below. Using the Honeywell W136A Test Meter or equivalent. Disconnect the ground wire from the S87. Connect the red (positive) meter lead to the free end of the ground wire. Connect the black (negative) meter lead to the quick-connect ground terminal on the S87.
2. Restart the system and read the meter. The flame sensor current must be at least 1.5 uA and steady. If the reading is less than 1.5µA or unsteady, see LOW OR UNSTEADY FLAME CURRENT section, below.

   If a flame is present at sensor and a reading of zero uA is obtained, check for a secondary ground connection to the 24V (GND) terminal. If secondary connection exists, temporarily remove connection and measure flame current.



A good rectifying flame is achieved with approx 1" of sensor in a strong blue flame, positioned 1/4" to 1/2" away from flame source surface.



A lazy or weak flame is not a good rectifying flame.
Check gas pressure and gas orifice for insects, and spider webs.

LOW/ UNSTEADY FLAME CURRENT

If the current to the S87 flame circuit is less than 1.5 µA or is unsteady, check the burner flame, flame sensor location and electrical connections as follows.

Electrical Connections and Shorts

Connections at the flame sensor must be clean and secure. If wiring needs replacement, use moisture resistant #18 wire rated for continuous duty up to 221^0 F [105^0 C].

Flame Sensor

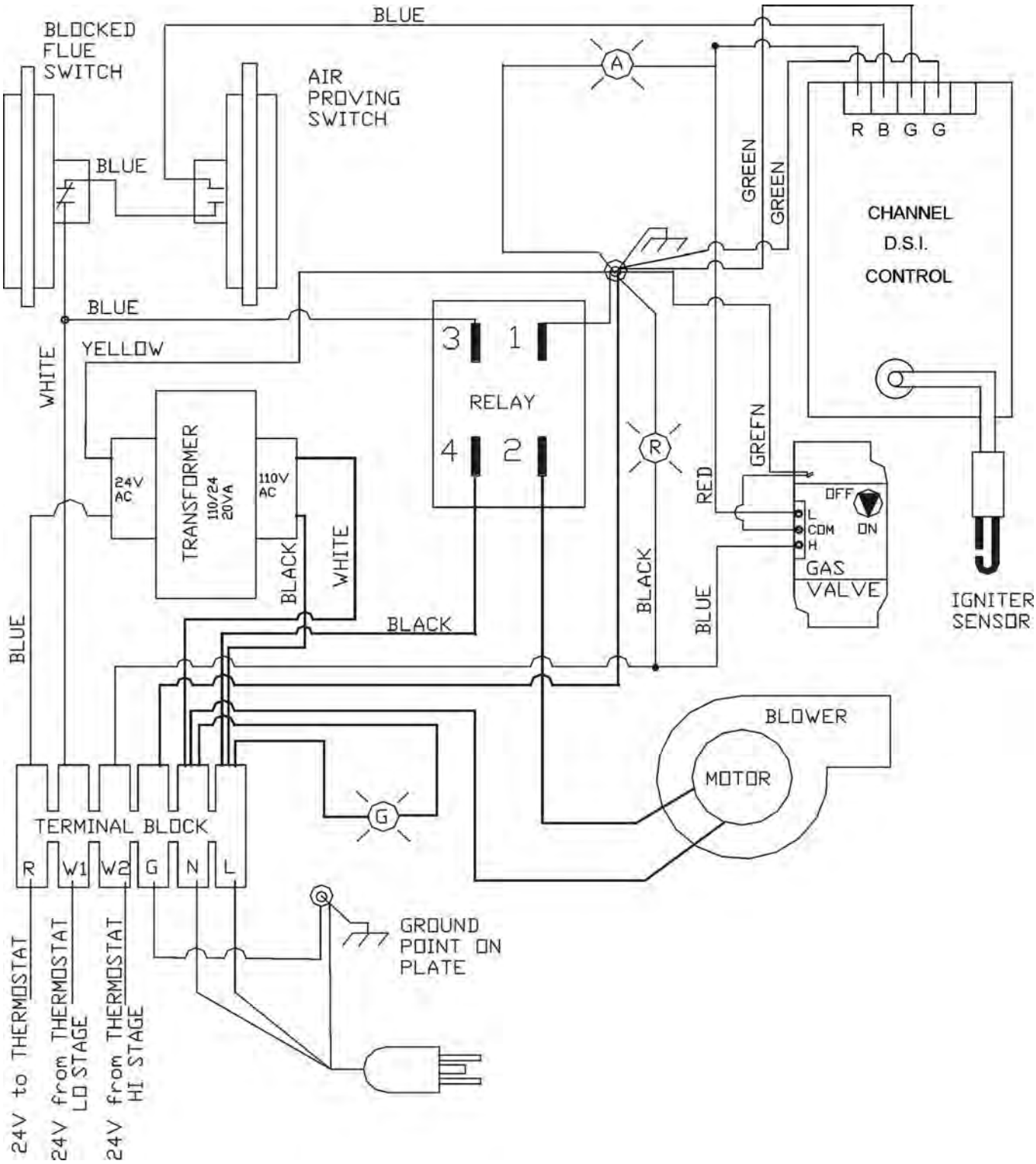
The flame signal is best when about 1 in. [25 mm] of flame rod is immersed in the burner flame. A bent flame rod, bent mounting bracket or cracked ceramic insulator will affect flame signal.
Replace flame sensor if necessary.

Burner Flame

The flame sensor must be constantly immersed in flame. Check burner flame condition as shown opposite. Observe burner rating plate for the correct gas pressure, and check with a manometer. If gas pressure is correct check line and orifice for obstructions.

CHANNEL MICRO 50N: WIRING DIAGRAM: 2-STAGE THERMOSTAT CONTROL

OTHER DSI's: FENWAL SEE PAGE 31; HONEYWELL S87J - PAGES 53- 55



The heater must be electrically grounded in accordance with the National Electrical Code. ANSI / NFPA 70 or current Canadian Electrical code CSA C22.1.

CHANNEL MICRO 50N DSI: SEQUENCE OF OPERATION

The MICRO 50N is a three trial ignition control module with a 30 minute soft lockout/reset. It is powered through a safety control circuit by a 24v transformer that is activated when the thermostat calls for heat. On every call for heat the MICRO 50N will delay start-up with a 30 second system pre-purge. After pre-purge an electronic generator powers the spark igniter and retrial/ safety lockout timing begins. At the same time, the gas control valve is opened allowing gas to flow to the burner.

The MICRO 50N Control Module performs the following basic functions:

- Provides a 30 second system pre-purge
- Supplies power to the electronic pulse-generator circuit for the spark igniter (30,000 volts open circuit).
- Allows up to three 20 second trials for ignition before a 'soft' system safety lockout of 30 minutes occurs.
- Three time trial for ignition and soft 30 minute lockout repeat
- Senses the burner flame for flame maintenance
- Shuts off the spark sequence after flame is established

Burner operation sequence:

1a. **Line Voltage Thermostat:** A call for heat by the line voltage Thermostat or an "ON/OFF" switch, powers the blower and 120/24 volt Transformer simultaneously … *continue to* 2.

1b. **24 Volt Thermostat:** *NOTE: Requires Optional Relay Kit JS-0568-KT - field installs in burner for 24V thermostat control of a single heater. Multiple heaters per 24Vac thermostat require optional Control Center JM-0303-KT (see previous page).*

The 120 Vac supply to the burner simultaneously provides power to a 120/24V transformer and the 120V terminal of a relay switch (open). When the 24 Vac thermostat calls for heat the coil of the 24/120 volt relay switch is energized and closes 120Vac to the blower.

2. 24 Vac is provided to the proving air switch. The blower air supply creates a positive pressure and closes the normally open proving air switch, closing 24 Vac to the normally closed blocked flue switch.
3. Provided there is no blockage in the system (tube and vent), the blocked flue switch remains in a normally closed position.
5. 24 Vac is supplied to the DSI control and the 30 second pre-purge cycle is initiated.
6. After completing the 30 second pre-purge cycle, the DSI control generates high voltage to the spark igniter, and 24 Vac to energize the Gas Valve.
7. The burner ignites and establishes a steady flame.
8. Once the flame sensor (part of the spark igniter) determines there is a steady flame established, with a minimum flame signal of 1.5 µA to the control, ignition spark is de-energized.
9. In the event ignition does not occur, the DSI control will retry the ignition sequence up to an additional two trials. If ignition does not occur after the third ignition trial, the system will enter a 30 minute 'soft' lock-out. This will reset the ignition module and the operating sequence will restart at step #1 after the 30 minute soft lock-out period.
10. If there is a loss of flame during the run mode, the unit will energize the spark within 0.8 seconds and perform a trial for ignition without the gas valve being closed first (Spark Restoration). If a flame is not established during Spark Restoration the unit will repeat the process in step number 9 (above).

CHANNEL MICRO 50N IGNITION CONTROL - SPECS

The MICRO 50N is a microprocessor-based DSI (Direct Spark Ignition) control which continuously monitors the entire system to ensure safe operation under all conditions.
Features of the MICRO 50N DSI Control include 30 second purge and 20 second ignition trial, with three ignition attempts, a diagnostic alarm output, automatic recycle on lockout (soft lockout).

SPECIFICATIONS

Operating Voltage:	24 VAC, 50/60Hz
Power Consumption:	200mA maximum, exclusive of valve/alarm loads
High Voltage:	15kV minimum with 50 pF load
Spark Gap:	3/16” [4.8 mm]; 0.150 inches +/- 0.050 inches [3.8 mm +/- 1.2 mm]
Spark Rate:	60 sparks per second
Gas Valve Output:	2A maximum
Alarm Output:	2A maximum, dependent on optional alarm type
Operating Temperature:	-40°F to +185°F (-40°C to +85°C)
Environmental Protection:	Polyurethane encapsulated units pass 500 hour salt spray test to ASTM 117
Mating Connectors: 6 Pin:	MOLEX 08-50-8063 or equivalent

NORMAL OPERATING SEQUENCE

Power up / Pre-purge
When powered up, the unit performs a series of diagnostic checks to determine if the system is in working order.
Trial for Ignition
After a pre-purge, the unit will power the valve solenoid and begin a trial for ignition. The spark will be enabled for the first 80% of the trial period and then suppressed for the last 20% of the trial period to allow the unit to sense weak flame signals.
Run
When a flame is sensed, the unit suppresses the spark and keeps the valve powered. Power is removed from the unit when the thermostat is satisfied.

ABNORMAL CONDITION OPERATING SEQUENCE

No Flame Established - *Soft Lockout Mode*
If a flame is not established during the trial for ignition, the unit will perform an inter-purge and retrial for ignition. This protocol is followed for the number of tries specified. If a flame is not established during the final ignition attempt, the unit will enter the soft lockout mode, which includes a reset delay before another normal trial for ignition series begins.
Loss of Flame - *Spark Restoration Retrial*
If there is a loss of flame during the run mode, the unit will energize the spark within 0.8 seconds and perform a spark restoration trial for ignition. In this mode, the ignition means is restored without the gas valve being closed. If a flame is not established during the restoration trial, the unit will perform as in “*No Flame Established”* fault operation above.
Leaking Valve - *Hard Lockout Mode*
If a flame is present when the gas valve is not energized, the unit will enter the hard lockout mode.
Internal Fault - *Hard Lockout Mode*
If an internal fault is detected within the unit, the unit will enter the hard lockout mode.
System or External Fault - *Hard Lockout Mode*
If the unit detects a system fault or an external fault, the unit enters the hard lockout mode.

Schwank
INNOVATIVE HEATING SOLUTIONS

LIMITED WARRANTY CERTIFICATE

infrasave
radiant heaters

FOR GAS-FIRED INFRA-RED LOW INTENSITY TUBE HEATERS: SET / SETU & ITT / ITTU SERIES

The Manufacturer warrants that this product is free from defects in material or workmanship under normal use and service subject to the terms of this document.

TWO YEAR WARRANTY

Subject to the conditions and limitations stated herein, during the term of this limited warranty, we will supply any component part (at our option a new or repaired component part) of the heater as defined below, excluding any labor , which the Manufacturer's examination determines to be defective in workmanship or material for a period of two years (2 years) from the date of installation, unless otherwise specified below. This warranty applies to the heater's original owner, and subsequent transferees and only if the unit is installed and operated in accordance with the printed instructions accompanying the unit and in compliance with all applicable installation codes and good trade practices. Warranty is only applicable to Schwank components, other parts are limited to their own Manufacturers warranty period of one year (1 year).

FIVE YEAR WARRANTY

The Manufacturer warrants the burner sub-assembly comprising of ceramic and immediate metal tubing, and the radiating tubes (excluding couplings) for a period of five years (5 years).

WHAT IS NOT COVERED

The Manufacturer shall not be responsible for any expenses, including service, labor, diagnosis, analysis, material or transportation charges incurred during removal or reinstallation of this product, or any of its components or parts. All labor or service charges shall be paid by the owner. This warranty does not cover heating products improperly installed, misused, exposed to or damaged by negligence, accident, corrosive or contaminating atmosphere, water, excessive thermal shock, impact, abrasion, normal wear due to use, alteration or operation contrary to the owner's manual or if the serial number has been altered, defaced or removed. This warranty shall not apply if the input to the heating product exceeds by more than 2% of the rated input on the rating plate. The Manufacturer shall not be liable for any default or delay in performance by its warranty caused by any contingency beyond its control, including war, government restrictions, or restraints, strikes, fire, flood, acts of God, or short or reduced supply of raw materials or products.

WARRANTY PROCEDURE

To establish the installation date for any purpose under this Limited Warranty, you must retain the original records that can establish the installation date of your unit. If you do not provide such documents, the start date of the term of this Limited Warranty will be based upon the date of unit manufacture, plus thirty (30) days. Failure to maintain the equipment through regular annual service maintenance by a qualified service technician shall void the warranty.

LIMITATIONS AND EXCLUSIONS

This document contains all warranties made by the Manufacturer and may not be varied, altered or extended by any person. There are no promises, or agreements extending from the Manufacture other than the statements contained herein. THIS WARRANTY IS IN LIEU OF ALL WARRANTIES EXPRESSED OR IMPLIED, TO THE EXTENT AUTHORIZED BY THE LAWS OF THE JURISDICTION, INCLUDING SPECIFICALLY THE WARRANTIES OR MERCHANTIBILITY OF FITNESS FOR A PARTICULAR PURPOSE.

It is understood and agreed that the Manufacturer's obligation hereunder is limited to repairing or replacing parts determined to be defective as stated above. In no event shall the Manufacturer be responsible for any alleged personal injuries or other special, incidental or consequential damages. As to property damages, contract, tort or other claim the Manufacturer's responsibility shall not exceed the purchase priced paid for the product.

All replacement parts will be warranted for the unused portion of the warranty coverage period remaining on the applicable unit.

Some Authorities do not allow certain warranty exclusions or limitations on duration of warranty or the exclusions or limitations of incidental or consequential damages. In such cases, the above limitations or exclusions may not apply to you and are not intended to do so where prohibited by law. This warranty gives you specific legal rights. You may also have other rights which vary by jurisdiction.

SCHWANK GROUP
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